Appendix 2.12 – Five Examples of HHE Letter Reports

Strategic goal 1

NASA Goddard Space Flight Center, Greenbelt, MD. HETA 2004-0074

Issue: Possible brain cancer cluster related to electromagnetic field exposures

Cargill Sweeteners North America, Blair, NE. HETA 2004-0153

Issue: Risk of histoplasmosis due to excavation of contaminated soil

Strategic goal 2

The Arc of Tuscaloosa County, Tuscaloosa, AL. HETA 2000-0043

Issue: Exposure to metal dusts at a sheltered workshop

United States Department of Agriculture, Fort Collins, CO. HETA 2001-0233

Issue: Exposure of government exposures to scrapie-infected sheep in a slaughterhouse

Strategic goal 3

Federal Emergency Management Agency, Richmond, VA. 2004-0042

Issue: Hazards to federal response workers after a hurricane

DEPARTMENT OF HEALTH AND HUMAN SERVICES Public Health Service

National Institute for Occupational Safety and Health
Robert A. Taft Laboratories
4676 Columbia Parkway
Cincinnati OH 45226-1998

January 10, 2005
HETA 2004-0074

Terrence A. Bidnick, MD, MPH
Medical Director/Project Manager
NASA Goddard Space Flight Center
MS 250.9 Bldg 97
Greenbelt, Maryland 20771

Dear Dr. Bidnick:

On December 10, 2003, the National Institute for Occupational Safety and Health (NIOSH) received a management request for technical assistance at the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC). Workers had reported a possible cancer cluster that included nine workers who had a diagnosis of brain tumor. Some workers expressed concern that the brain tumors might have been caused by exposure to electromagnetic fields (EMF) in the workplace. Therefore, NASA GSFC authorized EMF surveys in two buildings where the workers with brain tumors worked and also in another building for comparison.

We reviewed information about the brain tumors, including the report that included analyses of observed and expected brain tumor rates, and the reports of the EMF surveys at GSFC. When we visited GSFC on May 20, 2004, we took some EMF measurements in the building where employees had most concerns about the methods and results of the earlier surveys.

For the following reasons, the reported brain tumors do not meet our criteria for a work-related or EMF-related cluster:

- The reported brain tumors—meningioma, acoustic neuroma, and astrocytoma—did not originate from a single type of tissue
- The tumors are not unusual among persons of working age in the general U.S. population
- Meningioma and acoustic neuroma are slow-growing tumors that might have already started growing before employment at GSFC
- Although some controversy still exists, scientific evidence and epidemiologic studies have not shown a definite cause-and-effect relationship between EMF exposures and brain tumors
- No unusual EMF exposures were found in the buildings that were occupied by GSFC workers who developed brain tumors

This letter, which represents the final report of this NIOSH health hazard evaluation, contains a short history about our experience with disease clusters, criteria for work-related disease clusters, a description of what we did for this evaluation, our conclusions and their reasons, our recommendations, and information sources on the internet.

The NIOSH experience with disease clusters

Over the years, NIOSH has received many requests for evaluations of apparent clusters of cancers, birth defects, and other diseases among employees in a variety of workplaces. Concerns about similar illnesses among employees or coworkers are understandable. Because cancer is common in the United States, it can be found among people at any workplace. This often leads workers to suspect that cancers among coworkers might be related to work. However, in the United States, one in two men and one in three women will develop some type of cancer in their lifetime; one of every four deaths is from cancer. These figures show the unfortunate reality that cancer occurs more often than many people realize.

Most of the reported disease clusters that we have evaluated have not been related to workplace exposures. Nevertheless, the possibility that a disease cluster is caused by a workplace exposure deserves attention. If a disease-causing agent is present in a workplace, the employer should take steps to prevent future cases of disease by reducing or eliminating exposures to that agent. For this reason, we continue to evaluate disease clusters reported to us.

Criteria for a work-related disease cluster

Diseases such as cancers often appear to occur in clusters, which scientists define as an unusual concentration of a specific disease within a defined group of people, geographic area, and period of time. Reported diseases are more likely to meet the criteria for a cluster when:

- A large number of workers have a specific type of diagnosis, rather than several different types of diseases
- The specific type of disease is rare, rather than a common type
- The affected workers are in an age group that is not usually affected by that type of disease

The reported disease is more likely to be related to work when:

- Factors outside the workplace (such as family history, childhood exposures, home or community exposures, and exposures from previous jobs, hobbies, diet, and habits such as smoking tobacco) cannot explain the disease
- Workers who have similar jobs or similar exposures in other workplaces have developed the same disease
- People with different types of jobs or exposures have not developed the disease

- A potentially hazardous exposure existed in the workplace, and there are logical explanations for how workers were exposed
- The proposed mechanism for the exposure to cause the disease makes sense biologically
- Enough time has passed since first exposure for an exposure to cause disease and for the disease to develop to a detectable stage. This time interval is called the "latency period."
- Workers with higher exposures were affected more than workers with lower exposures

What we did

Dr. Elena Page and I, medical epidemiologists in occupational health, reviewed the draft report of a brain tumor cluster evaluation and an assessment of health concerns that were conducted in GSFC buildings 7, 10, 15, and 29 by the NASA GSFC Safety and Environmental Division.

Dr. Joseph Bowman and Dr. W. Gregory Lotz, NIOSH EMF researchers, and Dr. Mark Methner, NIOSH industrial hygienist, reviewed the following documents: (1) a draft report of the EMF survey conducted by a contractor in buildings 6, 7, and 29 in January and February 2004, (2) additional data collected by the contractor in April 2004, and (3) a draft report of the survey of extremely low frequency (ELF) electromagnetic spectral fields in buildings 6, 7, and 29 that was conducted by NASA GSFC staff in January, February, and March of 2004. Dr. Lotz and Dr. Bowman communicated with the radiation safety officer and an employee who had concerns about EMF and the validity of the NASA GSFC surveys.

On May 20, 2004, Dr. Bowman conducted a survey of spot EMF measurements in building 7. He focused on areas identified by concerned employees.

Dr. Bowman and I presented our conclusions at an all hands' meeting at GSFC on May 20, 2004. We provided copies of our presentations to NASA GSFC to make them available to employees who did not attend the all hands' meeting.

What we conclude about the reported brain tumors

The reported cancers do not meet the number criterion for a brain cancer cluster

Two of the nine workers with brain tumors had malignant tumors (cancers). The other tumors were benign. One cancer was an astrocytoma, which originates from brain tissue. The other was a neuroendocrine tumor, presumably a cancer, whose origin could not be identified. Only one of these cancers was positively identified as a brain cancer. Because a cancer cluster requires that more than one worker have a specific type of cancer, we do not consider this to be a brain cancer cluster.

The benign brain tumors do not meet single-type or rare-occurrence criteria

Five of the reported benign tumors were meningiomas, which arise from the meninges (the tissues that cover the brain and spinal cord). Meningioma is not a tumor of brain tissue. It is not an unusual type of tumor and, among adults of working age, accounts for up to 30% of all tumors affecting the brain.[1]

Two of the reported benign tumors were acoustic neuromas (also known as vestibular schwannomas). These tumors arise from Schwann cells of the nerve sheath, and are different from astrocytoma and meningioma. Acoustic neuroma accounts for about 9% of all tumors affecting the brain.[1]

Benign brain tumors typically do not cause death unless the tumor location or size affects a function that is important for survival. Therefore, the number of people who already have a diagnosis of meningioma or acoustic neuroma will be greater than the number of people who are diagnosed each year. Over the years, the number of workers who have a brain tumor may increase. This could cause workers to suspect that the tumors were clustered in their workplace.

Some factors that are not related to work are known to cause or contribute to the development of brain tumors

Ionizing radiation is a well known and potent cancer-causing agent. High-dose ionizing radiation to the head during childhood is a well established risk factor for brain tumors such as meningioma and acoustic neuroma.[2,3,4] Certain rare genetic disorders also increase the risk of brain tumor.[2,3,4] Factors unrelated to work, such as diet, tobacco use, and previous head injury, may also be risk factors.[2,3,4]

Because workers in certain industries appear to have an increased risk of brain tumor, researchers have studied and continue to study specific work exposures, such as ionizing radiation, EMF, and pesticide exposure, to see how they are related to brain tumors. To date, these studies have shown no consistent relationship between workplace exposures and brain tumors.[2,3,4]

It is likely that the benign tumors began growing before the affected employees started work at NASA GSFC

The estimated latency period for meningioma caused by ionizing radiation is 20 to 40 years.[5] The latency period for acoustic neuroma may be slightly shorter.[6]

Information about the year of hire was available for four of the five GSFC workers with diagnoses of meningioma. The time from year of hire to year of diagnosis for each of these workers was 3, 12, 15, and 23 years, respectively. Meningioma is slow-growing and its latency period after exposure to a potent tumor-causing agent (ionizing radiation) is 20 to 40 years. Therefore, it is likely that three and possibly all of the reported meningiomas had started growing before employment at GSFC. At the time of diagnosis, the two employees

with acoustic neuroma had been working at GSFC for about 2 and 10 years, respectively. Acoustic neuroma is also slow-growing. Therefore, it is likely that these acoustic neuromas had started growing before employment at GSFC.

What we conclude about EMF at NASA GSFC

The evidence that EMF in workplaces causes brain cancer is weak

After more than 20 years of studies, the evidence relating EMF exposure to brain cancer remains mixed. Some studies have shown occupational exposures to EMF to be associated with brain cancer, but others have not.[7] In addition, no biophysical mechanism has been established to explain how weak magnetic fields, such as those found at GSFC, could cause disease. Animal studies have not shown that EMF exposure increases the risk for brain cancer. On the basis of several human epidemiologic studies, the California Department of Health Services rated occupational EMF a "possible carcinogen,"[8] but other expert governmental reviews have found the scientific evidence inadequate to classify EMF as a cancer-causing agent.[9,10] Thus, the evidence linking cancer to EMF exposures is too weak to be a basis for government regulations. Existing exposure limits were set to prevent biological effects that can occur when exposures are more than a thousand times above the levels found in epidemiologic studies of EMF exposure and cancer.[11]

The surveys at NASA GSFC showed much lower EMF levels than those measured in the epidemiologic studies that suggested an association between EMF and brain cancer

Surveys of the two buildings where workers with brain tumors spent most of their time showed EMF levels that were much lower than the levels associated with brain cancer in the epidemiologic studies that showed a relationship between EMF and brain cancer. One study of brain cancer and leukemia among several groups of electric utility workers found significant risks for brain cancer only when cumulative magnetic field exposures were greater than 160 milliGauss-years.[12] The only measurements in frequently occupied offices at GSFC that could possibly approach this cumulative exposure were the maximum exposures of 4 milliGauss in rooms 37, 172, and MM1&2 of building 7. To reach the level of exposure that was associated with a significant risk of brain cancer, exposure at the maximum measurement would have to be sustained for 40 hours per week for 40 years. It is unlikely that a GSFC worker would have accumulated this level of exposure. Exposures in any one spot vary and are not always at the maximum level. In fact, other EMF results in the same rooms as the maximum measurements were between 0.1 and 1.7 milliGauss. In addition, GSFC workers were reported to move about the building and to other buildings during the course of their work. They do not remain in the same work area 40 hours per week for 40 years of employment.

EMF measurements of overhead power cables and electric equipment in the basement of building 7 did not indicate a concern

Dr. Bowman took magnetic field measurements in building 7 to address worker concerns, specifically in the basement near the overhead power cables and near the cables to the

shaker with the shaker power on. He also took measurements in the sewing room near sewing machines during use and at a work table under low-hanging overhead fluorescent lighting. Some overhead cables and fluorescent lights showed increased EMF levels, but seldom above 5 milliGauss. The higher measurements were taken next to EMF sources which, in some locations, were close to but not at head height. EMF levels rapidly decreased away from the source. EMF levels from the sewing machine motors, which were close to the floor, decreased to normal levels near the operator's head. EMF levels did not increase when the shaker power was turned on. According to these measurements, it is unlikely that long-term average EMF exposures of workers in building 7 would approach the levels associated with brain cancer in the epidemiologic studies that showed a relationship between EMF and brain cancer.

There is no evidence of adverse health effects from higher frequency EMF exposure

Some electric equipment (such as computer monitors) generates EMF at frequencies higher than the bandwidth of 60 Hz meters. However, few epidemiologic studies have looked at workers exposed to these higher frequencies. Studies of telephone operators using computer monitors showed no association with reproductive effects compared to operators using liquid crystal displays.[13,14] Studies with radio frequency EMF have also shown no effects from frequencies over a million times higher than 60 Hz.[15] The mechanisms by which EMF may cause cancer are not understood well enough to extrapolate the risks observed with 60 Hz EMF to higher frequencies. Thus, the concerns raised by GSFC employees about health effects related to exposures from higher frequency sources cannot be addressed by current knowledge; but no additional health risk has been suggested.

What we recommend

A study of brain tumors among NASA GSFC workers is not recommended

Even if other NASA centers were included in a study, an epidemiologic study of EMF and brain tumors is not recommended for the following reasons:

- When a reported cluster does not meet criteria for a possible work-related cluster, further epidemiologic studies would not be expected to find the cause of the disease.
- Any epidemiologic study of this workforce would have the following limitations:
  - Workers whose first exposures occurred before the estimated latency period should be included in the study. Because the workforce has changed over time, locating workers who meet the latency criterion could be problematic.
  - Projects have changed over time and workers' tasks have changed to meet project needs. Thus, estimating exposures related to specific work tasks would be complicated. Estimating individual worker exposures would be even more challenging.

Although the reported brain tumors do not meet our criteria for a work-related disease cluster, workers are likely to have concerns about workplace exposures and their personal

risk for cancer. Therefore, we recommend that NASA GSFC inform employees about the following:

- Measures taken by management to reduce employee health risks
- Known cancer risk factors
- Measures employees can take to reduce their risk for preventable cancers
- Availability of cancer screening programs
- Ongoing worldwide research looking for work-related causes of cancer

Further EMF surveys are not recommended to assess exposures that might have caused brain tumors

In our experience, employee concerns about an apparent disease cluster typically lead to a search for work-related exposures that might have caused disease. When a reported cluster meets our criteria for a work-related cluster, we recommend an evaluation of the workplace environment to look for possible disease-causing agents. When the reported cluster does not meet criteria for a work-related cluster, we do not recommend environmental evaluations to look for exposures.

At GSFC, we would not have recommended the EMF surveys on the basis of the reported brain tumor cluster. The results of the EMF surveys already conducted at GSFC do not suggest a need for further surveys. On the other hand, if a change in the work environment is expected to cause an unusual or high exposure to EMF, measurements of EMF could be justified.

Prudent avoidance of EMF exposure

In its final report on the EMF Research and Public Information Dissemination (EMF-RAPID) program, the National Institute of Environmental Health Sciences of the National Institutes of Health (NIH/NIEHS) suggested that Athe level and strength of evidence supporting ELF-EMF exposure as a human health hazard are insufficient to warrant aggressive regulatory actions; thus, we do not recommend actions such as stringent standards. . . . Instead, the evidence suggests passive measures such as continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures.@[10]

In workplaces, the most effective means to address employee concerns about EMF include identifying sources of above average EMF, moving employee workstations away from fixed EMF sources to locations with lower exposures, moving EMF sources away from employees (e.g., raising the low-hanging overhead fluorescent lighting), and educating employees about possible health effects. This approach of reducing exposures while the health evidence still has uncertainties has been called the Aprecautionary principle@ and Aprudent avoidance."[16,17] NASA has already taken many of these steps at GSFC.

Survey measurements should allow meaningful interpretation

If NASA should decide to do additional EMF surveys at GFSC, measurements should be taken in a manner that can be compared directly with reference values that are related to health effects. Unless NASA GFSC obtains new equipment that generates EMF so high that they approach the exposure guidelines,[11] the best reference values at the moment are the levels associated with significant cancer risks in epidemiologic studies.[12] These studies were done with personal monitors that record the magnetic fields over the entire workday and compute the time-weighted average. The NIOSH Manual for Measuring Occupational EMF Exposures[18] provides tested methods for taking such measurements. In any case, the purpose of the survey should be clarified and the usefulness and limitations of its measurements should be evaluated and stated beforehand.

Requirements for posting the NIOSH Report

This letter serves as a final report and concludes this health hazard evaluation. In accordance with the Code of Federal Regulations, Title 42, Part 85, Section 85.11, the employer must post a copy of this letter for 30 days at or near work areas of affected employees.

Thank you for your cooperation with this evaluation. If you have questions or concerns about this report, please do not hesitate to contact me at (513) 841-4526 or mkawamoto@cdc.gov.

Sincerely yours,

Melody M. Kawamoto, M.D., M.S.
Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations and Field Studies

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Information Sources on the Internet

Electromagnetic Fields (EMF)

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

Safety and Health Topic: EMF (Electric and Magnetic Fields)
www.cdc.gov/niosh/topics/emf/

NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

Electric and Magnetic Fields Research and Public Information Dissemination Program
www.niehs.nih.gov/emfrapid/booklet/home.htm

Brain Tumors

NATIONAL CANCER INSTITUTE

Brain Tumor
www.cancer.gov/cancertopics/types/brain
What you need to know about brain tumors
www.cancer.gov/cancertopics/wyntk/brain

AMERICAN CANCER SOCIETY

Detailed Guide: Brain / CNS Tumors in Adults
www.cancer.org/docroot/CRI/CRI_2_3x.asp?dt=3

or

www.cancer.org
Under “Patients, Family, & Friends,” click on “Choose a cancer topic,”
click on “Brain / CNS Tumors in Adults,” then click “Go”

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

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March 29, 2004
HETA 2004-0153

Mr. Todd Friis
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Dear Mr. Friis:

Beginning February 26th, 2004, representatives from the Centers for Disease Control and Prevention (CDC) visited the Cargill Sweeteners campus in Blair, Nebraska. A medical officer from the CDC's National Center for Infectious Diseases (NCID), Dr. Sharmila Shetty, was present at the invitation of the Nebraska Health and Human Services System to conduct an epidemiologic investigation of possible cases of histoplasmosis among the facility's employees. The site visit was made due to concerns that a second outbreak of histoplasmosis was occurring among the employees at the worksite, following one that had occurred in August 2003 in which 43 clinically or laboratory confirmed cases were identified. Representatives from CDC's National Institute for Occupational Safety and Health (NIOSH) participated as part of the response to provide assistance with industrial hygiene and occupational health–related issues. This letter details the activities and recommendations from this component of the site visit.

INTRODUCTION

The 650-acre Cargill campus in Blair, Nebraska, located approximately 25 miles north of Omaha, hosts several companies, including Cargill Sweeteners, Polyols, Cargill Dow LLC, and PGLA-1. Additionally, facilities owned by Purac and Midwest Lysine (a Degussa company) operate on the campus. All are involved in corn processing for the development of a number of products, including sweeteners, ethanol, animal feed, lactic acid, and plastics used to produce woven fibers and packaging products. Additionally, more than 20 contracting companies work throughout the campus performing various services for the companies located on this campus. At the time of the survey, approximately 300 contractors were working at the Cargill site along with approximately 575 employees of the various companies located at this facility.

BACKGROUND

Concern about exposure to *Histoplasma capsulatum* (*H. capsulatum*) began in mid-August, 2003, when 43 employees of the facility were either clinically diagnosed or laboratory confirmed to have histoplasmosis. An epidemiologic investigation by the Nebraska Department of Health

and Human Services System indicated that soil excavated for pipe repair in an area of the facility associated with a large accumulation of bird droppings was a likely cause of aerosolization of *H. capsulatum* spores and thus, the possible site of the employees' exposures.

In mid to late January 2004, several employees at the Cargill campus began reporting symptoms possibly associated with histoplasmosis and/or had a doctor's diagnosis of histoplasmosis. Unlike the August 2003 incident, there had been no soil excavation activities. However, a spoil pile (excavated dirt remaining from the August 2003 pipe repair) had been transferred on January 2, 2004, from a site on the eastern edge of the facility to a dumpster for transportation to a landfill. The dirt had been moved using a front-end loader and there was concern that dust from this activity could be associated with the symptoms reported by the workers. The Nebraska Department of Health and Human Services System requested an Epi-Aid investigation. The Mycotic Diseases Branch (MDB) of CDC's NCID planned to explore the extent of cases among the employees at the Cargill campus. MDB requested assistance from the Hazard Evaluation and Technical Assistance Branch (HETAB) of NIOSH to provide additional guidance to the companies to identify worker activities which may be at higher risk for exposure, the proper use of personal protective equipment (PPE) required for some of these activities, and recommendations for preventing future outbreaks.

ACTIVITIES, OBSERVATIONS, and DISCUSSION

Facility Survey

On Wednesday, February 25th, we met with representatives from the Nebraska Department of Health and Human Services System, including Ms. Brady Beecham and Dr. Alexandre Macedo de Oliveira, an Epidemic Intelligence Service Officer (EISO) stationed in Lincoln, Nebraska, who had investigated the original outbreak in August. Dr. Oliveira and Ms. Beecham reviewed the history of the site with us (i.e., the August 2003 outbreak) and the extent of activities for the current possible outbreak.

An opening conference was held on the morning of Thursday, February 26th at the Cargill campus to describe the epidemiology and occupational health components of the investigation. Over 20 individuals were present at this opening conference, including employees and management representatives of many of the companies and contractors. Following this meeting, we were briefed on the companies and contractors currently performing work and services on the Cargill campus.

Following the opening conference, we obtained an orientation of the campus by automobile. Several locations, including the ethanol facility, were mentioned as areas of concern as evidenced by the presence of accumulations of bird droppings. The flocks of birds were described to be particularly active in these areas in the evenings. Following this driving tour, a walking tour of process buildings provided an opportunity for a more detailed understanding of the work activities performed and the potential for exposure to *H. capsulatum*. The focus of the

walk-through on February 26th was the Cargill Dow portion of the campus, and included facilities such as Buildings CD-400, CD-700, and CD-800. During the walk-through, we visually inspected the rooftop heating, ventilation, and air-conditioning (HVAC) unit on the CD-700 building. At that time, we noticed that the pre-filters in the unit were not fitted properly. In fact, there were significant gaps between the filters through which contaminants could pass. While airborne *H. capsulatum* spores would not necessarily be captured by the pre-filters, these gaps suggest that the maintenance may not be sufficient and that the secondary air filters may not be installed correctly.

On February 27th, a walk-through of facilities on the Cargill side of the campus was conducted. All process buildings were toured where easily identifiable accumulations of bird droppings were present and job activities at these locations were discussed. Operations surveyed included the ethanol facility, the chemical unload station, and the distillation, fructose refining, corn refining, and feed load-out buildings.

During the visit, several buildings were noted to be sites where roosting birds had deposited accumulations of bird droppings. Most were limited to outdoor locations such as outside the ethanol facility and the area surrounding the chemical unload station. Although droppings were seen in a number of locations, such as sidewalks and buildings with large open doors, the accumulations were very limited, posing little hazard. For example, fresh bird droppings on surfaces such as sidewalks have not been shown to present a health risk for histoplasmosis.[1]

In the germ plant building, we noted that birds have begun to use the interior to roost, one of the only facilities on the campus where this is known to occur. The upper levels of this building were identified as a location where droppings were visible; employees were performing cleaning operations on the ground floor during the walk-through. We noted that Cargill has been working with the Nebraska Department of Natural Resources to deal with the large population of birds which roost on the campus.

We examined a street sweeper used to clean the roads on the Cargill campus. According to Cargill management representatives, the street sweeping equipment was used daily (per state regulation). On days when the ambient temperature was above freezing, water sprays were used to limit dust generation. However, during days below freezing, no water was used, often resulting in large clouds of dust. These procedures have changed to include only using the street sweeper on days when the water sprays can be employed, and to use it during times of the day when the fewest employees are present. Although there is no indication that dust on any of the roads on the campus is contaminated with *H. capsulatum* spores, the changes that Cargill has recently implemented (i.e., only sweeping when water can be used; sweeping during off-hours) should reduce the amount of dust released into the air.

We visited the facility on the Cargill Dow side of the campus where gypsum is produced as a by-product and mixed with dirt prior to disposal. In conjunction with this, we also toured the site off the western side of the campus where the dirt that is mixed together with the gypsum is removed from the ground and hauled to the gypsum site. At the time of the site visit, there were

no indications that the area from where fill dirt is obtained has been a bird roosting site or contaminated with bird droppings. Therefore, there is no reason to believe that soil from areas surrounding the campus, in particular the area from which this dirt is removed, is contaminated with *H. capsulatum*. However, should this procedure result in significant amounts of dust generation, dust suppression techniques may be considered.

We conducted a closing conference in the late afternoon of the 27th. Attendees included Mr. Jeff Anderson, Mr. Mark Boughter, and Dr. Sharmila Shetty. We presented an overview of our activities, observations made regarding tasks performed by employees, and recommendations which are believed to be helpful in minimizing the risk of exposure to potentially aerosolized *H. capsulatum* spores.

Employee Interviews

We met with the Gethman contractor who had been tasked to remove the spoil on the eastern side of the facility. The individual was responsible for loading the spoil pile on January 2nd into two dumpsters using a front-end loader; the dumpsters were removed to a landfill by a waste management contractor. The contractor discussed the methods used during this procedure, and provided a written protocol that described his activities. The protocol for this job was reviewed, which included limiting the number of workers in the area to the individual performing the work and using PPE (in this case, a powered air purifying respirator (PAPR) and coveralls). Dust suppression techniques (i.e., a water spray) and using both a plastic liner and a tarp to cover the dirt once it was transferred to the dumpster, as well as washing the equipment used for placing the soil into the dumpsters, were detailed. While the question was asked of how thoroughly soil needs to be wetted for appropriate dust suppression, no formal guidelines exist. We recommended that the operator use sufficient quantities so that a minimum amount of dust is generated throughout such soil moving procedures. It should be noted that during windy conditions, typical dust suppression techniques can be ineffective. Therefore, it is important to note the weather conditions to ensure that excavating or moving soil such as this is only performed during non-windy conditions.

We also met with four employees of Waste Management, the contracting company responsible for disposal of trash and waste products on the Cargill campus. Two of the employees were involved in transporting the dumpsters containing the spoil pile to the landfill on January 2nd. Discussions were held with these employees regarding the procedures used during the transport of this pile. We also answered their questions about histoplasmosis and the risks of exposure.

In many of the process buildings throughout the campus, we met with numerous employees to discuss their concerns about the risks associated with histoplasmosis and bird droppings.

Review of Health and Safety Plans

We met with several of the companies' health and safety managers to review a draft written plan recently developed to characterize activities regarding the risk for exposure to *H. capsulatum* spores, and the corresponding personal protective equipment (PPE) that would be required. We worked with company representatives resulting in recommendations for improvement. The end result was a plan detailing job activities according to three levels of risk: higher, lower, and minimal/no risk. Activities identified as higher risk include those involved in disturbing soil obviously contaminated with bird droppings or in disturbing accumulations of bird manure itself. An example of this is excavating soil at the ethanol facility. We concurred that the level of PPE required for activities such as this includes coveralls such as Tyvek®, rubber boots over normal work shoes, and a respirator providing a higher level of protection, such as a powered air-purifying respirator (PAPR) with high efficiency particulate air (HEPA) filters or a full-facepiece respirator with HEPA filter. For lower risk activities (such as those that disturb soil on the campus which has not been contaminated by bird droppings or during the changing of air filters from buildings or equipment), we recommended that the level of PPE may be decreased. Specifically, no coveralls are necessary and respiratory protection can be reduced to a NIOSH-certified N-95 filtering facepiece respirator. For those activities designated as minimal risk (such as those where no soil or bird droppings are disturbed), we recommended that no respiratory protection is required, but that N-95 filtering facepiece respirators should be available on a voluntary use basis.

We also reviewed the adequacy of the written respiratory protection program with Cargill and Cargill Dow health and safety representatives that had been sent electronically to NIOSH before the site visit. A number of aspects of this program were commented on by the NIOSH industrial hygienists. In general, it was felt that more detail needed to be added in a number of areas, including training, fit-testing, and maintenance and care of respirators. As mentioned during the site visit, many of these aspects are covered during the worker training; however, it is important that they also be included in the written respiratory protection program. Specific comments on the program have been sent under separate cover.

The Occupational Safety and Health Administration (OSHA) respiratory protection standard (Title 29 CFR 1910.134) details the requirements for all aspects of a proper respiratory protection program.[2] The extent of worker training for respirator use depends on the circumstances, but involves at a minimum, an opportunity for a worker to handle the respirator, a proper fitting, a test of facepiece-to-face seal, and a familiarizing period of wear in normal air. Fitting instructions for employees involve demonstrations and practice in wearing, adjusting, and determining the fit of the respirators. Employees must also be notified regarding the nature of the respiratory hazard, why a particular respirator has been selected, and how to recognize and handle emergencies. It is important that the respiratory protection requirements described in this plan be applied across all categories of employees on the campus, independent of their status as a contractor or a Cargill employee. As such, each company is responsible for ensuring that employees required to wear respiratory protection receive proper training in the use of a respirator. An example of the importance of worker training occurred during the walk-through of the germ plant building. Workers were observed cleaning the floor with a water spray. One of these workers was wearing a filtering facepiece respirator upside down, significantly

diminishing the level of protection this type of respirator can provide. Respirator training is emphasized to prevent such a recurrence.

RECOMMENDATIONS

- Ensure that all workers are knowledgeable about and have access to the plan developed by Cargill management detailing higher, lower, and minimal risk activities so that proper PPE can be selected and worn for those activities.

- Continue to exclude birds from entry by sealing all entry points. Continue to cooperate with the Nebraska Department of Natural Resources in activities to prevent birds from roosting on the campus.

- Update the written respiratory protection program to include more detailed information, including the areas of training, fit-testing, and maintenance and care of respirators.

- Ensure that all workers are knowledgeable in how to use PPE, particularly respirators, properly.

- Ensure that all HVAC units are maintained on a scheduled basis and, in particular, that its filters are fitted properly.

- Establish written procedures for street sweeping.

- Continue to pursue open communication among all parties on the Cargill campus. As a rule, open communication between employees and management is extremely important in discussing workplace risks and hazards, including those associated with histoplasmosis.

We were provided a list of questions posed to Cargill management by employees. This list, along with our answers, is provided in Appendix A.

This letter details recommendations based on information gathered during our site visit. Any additional future data may necessitate a refining of, or addition to, these recommendations. For purposes of informing affected employees, copies of this letter should be posted by the employer in a prominent place, accessible to the employees for a period of 30 calendar days. At this time, this letter will close the NIOSH file for this facility. However, should further information or assistance be needed, or if you have any questions, please do not hesitate to contact me at (513) 841-4462.

Sincerely yours,

Bradley S. King, MPH
Industrial Hygienist

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Determination: unknown

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[1] CDC [1997]. Histoplasmosis: Protecting Workers at Risk. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, National Center for Infectious Diseases. DHHS (NIOSH) Publication No. 97-146.
[2] CFR [1998]. 29 CFR 1910.134. Code of Federal Regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register. Website: http://www.osha-slc.gov.

APPENDIX A

CARGILL SWEETENERS, BLAIR, NEBRASKA
FREQUENTLY ASKED QUESTIONS ABOUT HISTOPLASMOSIS
POSED TO CARGILL MANAGEMENT BY EMPLOYEES

Commonwealth Electric Company of the Midwest

1. **Once the Histoplasmosis spore is airborne, how long does it survive before it is inert?**

   Like most fungal spores, the spores of *H. capsulatum* are very hardy. They do not become 'inert', or in other words, their ability to cause infection is not reduced significantly by the passage of time or after they have been made airborne.

2. **How long can the spores survive on your clothing?**

   Fungal spores can survive for a very long period of time. However, clothing that may have become contaminated with *H. capsulatum* spores would pose little risk after a washing cycle.

3. **Will purging nitrogen lines contribute to the spore growth?**

   No. Spore growth in soil is promoted by nutrients found in bird droppings. Nitrogen is an essential nutrient found in bird droppings, but there is no evidence to support that nitrogen purged from lines onto soil would be a contributing factor in spore growth. Aged droppings also provide an ideal growth environment due to the presence of other nutrients in addition to nitrogen.

Vac Con Industries

1. **Is there a hazard associated with working around bird droppings on hard, paved surfaces?**

   No. Fresh bird droppings on surfaces have not been shown to present a health risk for histoplasmosis. However, *H. capsulatum* spores can be found in accumulations of bird droppings that have collected on surfaces over a period of time. This is most likely caused by the presence of the spores on birds' feathers, feet, etc., rather then from the droppings themselves. Working around fresh bird droppings does not present a hazard compared to work involving the disturbance of accumulations that have occurred over time.

2. **When cleaning inside the plants, will we be required to wear minimum PPE at all times?**

   No. Cargill management has created a written protocol requiring certain levels of personal protective equipment (PPE) based on the perceived level of risk that certain activities may present. Employees should consult this protocol whenever questions arise as to whether PPE is necessary.

3. **Will using water as we clean lesson our exposure risk?**

   Yes. Often, water sprays are recommended as a method of reducing the amount of dust and spores aerosolized and thus decreasing the chances for exposure.

4. **Should a vacuum truck used at the Blair Facility be HEPA filtered?**

   Yes. For activities presenting a higher risk of exposure such as vacuuming accumulated bird droppings, a high efficiency particulate air (HEPA) filtered unit is appropriate.

5. **Is the everyday dust generated by truck traffic, etc., a concern at the facility?**
   No. While it is possible that some spores from areas of contaminated soil on or off the facility may settle onto road surfaces, we do not believe there is increased risk from dust generated by truck traffic.

6. **Do birds carry Histoplasmosis on their feathers, beaks, and feet?**

   Yes. It is possible that birds act as physical carriers of *H. capsulatum* spores. It has not been shown that they become infected with the disease and excrete the organism in their droppings.

7. **How will Cargill distinguish between high and low risk work areas?**

   Cargill has developed a written plan for higher and lower risk activities. Cargill considered such things as the amount of soil that may be disturbed and the presence of accumulated bird droppings. NIOSH investigators consider this to be a prudent approach to protecting the workers at this site.

CACO

1. **Will high temperature steam kill Histoplasmosis spores?**

   There is no information suggesting that high temperature steam will kill *H. capsulatum* spores. The spores of *H. capsulatum* are very hardy and can withstand a wide range of environmental conditions. One chemical proven to kill *H. capsulatum* in soil is formaldehyde; however, the health risks associated with using formaldehyde outweigh its benefits for this use. This is one reason why the EPA does not register any soil disinfectants containing this chemical.

2. **The bird population has increased dramatically at this site in the last two years. What is being done about it?**

   Cargill is working with the Nebraska Department of Natural Resources to prevent birds from roosting in/on the buildings on the Cargill campus.

Allied Services

1. **Are dead birds on the ground an issue with Histoplasmosis?**

   No. Dead birds are not an issue with histoplasmosis in the sense that they did not become infected and die from the disease. Their deaths may, however, be a result of attempts to control the bird population on the Cargill campus. Proper and prompt removal of bird carcasses is recommended.

2. **If Histoplasmosis is a fungus, how can it still grow and become airborne during cold and/or freezing weather?**

   H. capsulatum is a fungus which creates spores, which are extremely hardy under a range of environmental conditions. They can survive and become airborne even during cold and/or freezing weather.

3. **Are there any hazards of exposure to employees not working in areas where birds roost?**

   The risk of exposure to employees not working in areas where birds roost is thought to be no higher than the chances of exposure to the general population. Certain parts of the country, particularly in the Mississippi, Ohio, Missouri, and Rio Grande River valleys, are endemic areas for *H. capsulatum*, which means it can be found in soil naturally in higher rates than in other parts of the country. Often, large portions of the populations of

these areas have already been exposed to *H. capsulatum* spores at some time during their lives.

Newell Machinery

1. **How long do the Histoplasmosis spores live in the ground?**

   It is not known how long they can live in the ground. However, studies have shown that even after roost sites have been cleared, spores can be detected after as many as 10 years.

2. **How long can the Histoplasmosis spores live on your cloths?**

   Although spores can be very hardy, regular washing of clothes should reduce or eliminate any hazard.

3. **Does the pH of the soil affect growth of the Histoplasmosis spores?**

   Studies have shown that pH, as well as temperature and humidity, are important for promoting the growth of the fungus, but more work remains to be done to further explore the role these individually play in its growth.

Riesa Construction

1. **Why are we having Histoplasmosis cases now, when we have been performing the same jobs for years?**

   Unfortunately, there is no answer to explain why the outbreak occurred now. It is possible that the general population, or Cargill employees in particular, have been exposed in the past but were not aware of their exposure since the vast majority of infected persons have no apparent ill effects. Those that do often mistake their symptoms for the flu.

Securitas

1. **Can Histoplasmosis be transmitted from everyday foot traffic in office areas and security buildings?**

   No. Histoplasmosis is not transmitted by simple foot traffic in office areas and security buildings.

2. **What is the life span of Histoplasmosis once it is in the soil?**

   H. capsulatum spores have been shown to be able to remain in soil for many years, even after birds have stopped roosting at a particular site.

3. **Ethanol delivery drivers: Will they need to utilize respiratory PPE when they load ethanol?**

   No, unless they are disturbing accumulations of soil or aged bird droppings

4. **Can soil affected with Histoplasmosis leach into the surrounding, non-affected areas during the spring thaw season?**

   It is possible that spores could be distributed to surrounding areas via weather conditions such as high wind. Whether this would be sufficient to allow for growth in another area is unknown.

Interstates Electric

1. **Are we going to sample the soil in areas where birds roost?**

   NIOSH has no plans to sample the soil where birds are roosting although Cargill had considered collecting and analyzing soil samples for *H. capsulatum* as a possible option. Due to many constraints, such as time needed (as long as 8 weeks to get results back) and potential difficulty in interpreting the results, it is often recommended to take certain precautionary actions on the supposition that soil contaminated with bird droppings would be positive for *H. capsulatum* spores. Should future circumstances change the situation, the possibility of collecting samples will be re-evaluated.

Unicco

1. **Can Histoplasmosis grow outside of soil?**

   No. Soil or aged accumulations of bird or bat droppings are needed for growth of *H. capsulatum*.

2. **When performing excavations on site, how will Cargill notify people working near the dig site?**

   A system for such notification should be developed by Cargill management. It is important that all employees be notified of the hazards involved with this type of work.

3. **Under the current PPE protocol, is it safe to reuse a chemical suit after it is cleaned for the same job? Can the suit be re-used without the danger of spore contact with the employee's clothes?**

   Yes. For *H. capsulatum*, only light coveralls are needed for protection against contamination of clothing underneath the coveralls. A chemical suit is needed only when working with chemicals as required by company management or when working with water (to protect against getting wet). Should a chemical suit be used during activities where aerosolization of spores is possible, it is safe to reuse the suit, particularly if it is cleaned afterwards.

Miscellaneous Questions:

1. **Is there any danger associated with using the street sweeper on site?**

   There is no indication that dirt, soil, or dust present on any of the roads on the campus are contaminated with *H. capsulatum* spores. However, if dust is generated during street sweeping, there may be a potential for exposure. For this reason, we recommend that water sprays be used to reduce dust generation during days when the temperature is above freezing and when the fewest employees are around. Cargill has informed us that the prior policy of street sweeping when the temperature is below freezing has been discontinued.

2. **Will we need to take PPE precautions when it rains in areas with heavy bird activity?**

   No. Unless performing work as specified by the Cargill protocol for PPE, no special precautions are needed when it rains in areas with heavy bird activity.

3. **Is all the soil in the surrounding area to be considered positive for Histoplasmosis?**

   No. There are no indications that soil surrounding the campus, in particular the area from which fill dirt is removed, should be considered positive for *H. capsulatum* contamination. During the site visit conducted by NIOSH, the area from which fill dirt is taken was visited. There were no indications that the area is or has been a bird roosting site or contaminated with bird droppings.

4. **Are we going to survey and test other people in the outlying area who do not work at the Cargill facility?**

   No. The survey is strictly focusing on workers at the Cargill campus.

5. **Is the Blair Waste Water treatment facility an option for cleaning excavation equipment, etc. used in high risk areas?**

   It is recommended that equipment (e.g., front end loader) that has been used in higher risk areas be cleaned with water. Cargill management can determine if the waste water treatment facility is the most appropriate option.

6. **Do we need to be concerned with cleaning up new bird droppings off of sidewalks, equipment, etc?**

   No. The major concern is with aged accumulations of bird droppings. Fresh bird droppings on surfaces such as sidewalks, windowsills, and equipment have not been shown to present a health risk for histoplasmosis. Therefore, cleaning new bird droppings does not present a hazard.

7. **Will enclosing pipe rack and paving areas under where birds roost decrease the potential for Histoplasmosis in these areas?**

   Yes. Such measures may indeed decrease the chance that soil would become excessively contaminated with the *H. capsulatum* spores. Steps such as preventing birds from roosting at sites as well as preventing bird droppings from accumulating over long periods of time may be particularly helpful in decreasing the potential for growth of the fungus.

8. **Will NIOSH, CDC or the Health Department be conducting soil samples across the site to determine high-risk areas?**

   No. NIOSH investigators do not feel that soil sampling would be useful at this time. Should future information indicate sampling would be beneficial, the need for sampling can be reconsidered.

Additional Frequently Asked Questions

1. **If we must wear prescription glass inserts while using a full-face respirator, are these considered adequate eye protection?**

   A full-facepiece respirator is designed to cover the entire face. This includes a clear, plastic shield through which you can see, and which provides eye protection. If an individual wears prescription glasses, a spectacle kit designed and approved for use with the specific manufacturer's respirator would need to be used. However, they are only for vision correction, and not for eye protection.

2. **Is there a system to measure parts per million of the Histoplasmosis spore prior to performing work in a specific area?**

   No. Sampling methods do exist to detect *H. capsulatum* spores in soil or accumulated bird droppings. The sampling method recommended by NIOSH involves inoculating mice with portions of a sample. The mice are sacrificed after four weeks and their livers plated onto agar dishes and incubated for another four weeks for signs of growth of the fungus. Using this method, it can take up to two months to obtain results. Results are given as positive or negative for *H. capsulatum* growth, and not measured in parts per million. There are no exposure limits to which the results of sampling could be compared. The method of collecting the soil sample is also very important. For example, enough samples must be taken to be able to determine whether an area is positive for *H. capsulatum*. If done incorrectly or if too few samples are collected, hot spots may be missed giving a false sense of the extent of contamination. Considering the current limitations with soil sampling, it is often recommended to treat areas which have accumulated bird droppings to be potentially contaminated and to take the necessary precautions.

3. **Is there a danger of working in an area down-wind of the Cargill street sweeper operation?**

   There is no indication that the dust generated from the roads has a higher potential for contamination of *H. capsulatum* spores. However, as a precaution, it was recommended that the street sweeper be used only when temperatures allow for water sprays to be used to decrease the levels of dust generated. Additionally, it was recommended that the street sweeper be used only when minimal numbers of employees are present.

4. **Is there any danger of walking through areas where there are high concentrations of bird droppings and transferring spores into company vehicle from work boots?**

   It is possible to transfer spores from contaminated shoes to other locations, but the hazard of inhaling spores from this type of transfer is low.

5. **How far out will we need to barricade an area when performing work in the high-risk category?**

   No guidelines exist for determining such a distance and it will be necessary to make this judgment onsite. Individuals who are not necessary to the operation should remain away from the activity.

6. **When performing conduit work, etc. in high-risk areas, will we need to change our Tyvek suits each time we come down out of a cable tray; or could we hand the work off to another electrician?**

   When performing work in higher risk areas, it is not necessary to change Tyvek suits after each activity unless the suit's integrity is damaged (e.g., a rip or tear in the suit). Work can be handed off to another electrician if that person is wearing the proper PPE. It is recommended that the suit be disposed of properly after the work is done or a shift has ended.

7. **When pulling wire through cable trays in areas with heavy bird droppings, is there a danger of pulling the droppings into the Motor Control Center and releasing spores?**

   Because of unfamiliarity with this particular operation, it is difficult to recommend whether this is possible. However, attempts should be made to disturb bird droppings as infrequently as possible.

8. **Is PPE required for gripping of handrails which have some accumulations of bird droppings?**

   Gloves are recommended for good general hygiene in situations such as this.

9. **What is considered an "accumulation" of bird droppings?**

   No specified quantity or depth of bird droppings defines an "accumulation." Generally, accumulations occur where birds have been roosting for significant periods of time (years) and the bird droppings are considered suspect for contributing to the potential growth of *H. capsulatum* spores.

10. **Would a build-up of one month of bird droppings be considered dangerous?**

    No. Typically, growth of *H. capsulatum* spores is associated with accumulations of bird droppings that have occurred over a period of numerous months to years.

11. **Will my hard hat still afford me proper head protection if I wear it while also wearing a full face-piece respirator?**

    Yes. However, it is possible that certain hard hats will interfere with the proper wearing of a full-facepiece respirator. In situations such as this, it is important to correctly don the respirator first. Hard hats that have a bill extending from the front may not fit properly due to the presence of the full-facepiece respirator. In cases such as this, the company health and safety representatives should provide a modified hard hat to address

the problem. Employees should not forego wearing the proper PPE such as a hardhat due to circumstances such as this.

DEPARTMENT OF HEALTH & HUMAN SERVICES Public Health Service

National Institute for Occupational
Safety and Health
Robert A. Taft Laboratories
4676 Columbia Parkway
Cincinnati OH 45226-1998

April 19, 2002
HETA 2000–0043

Ms. Barbara Carroll
McGraw Center
The Arc of Tuscaloosa County
P.O. Box 40246
Tuscaloosa, Alabama 35404

Dear Ms. Carroll:

The National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) at the McGraw Center on November 3, 1999. Ms. Patricia Bailey, the facility's former program coordinator, requested the HHE because of her concern about the black, dusty material getting on the hands of workers handling videotape. No health problems associated with skin exposures to the dust were reported among employees. This letter presents the findings of our evaluation and recommendations to help ensure a safe work environment for workers in the McGraw Center's pre–vocational work area.

Background

Thirty people with developmental disabilities work in the pre–vocational work area of the McGraw Center. To fulfill a contract with JVC America, the workers remove waste videotape by hand from 4.5–inch diameter, plastic hubs. All videotape pulled from hubs is collected in 55–gallon cardboard drums, which are taken to a landfill for disposal. The hubs are put into plastic containers and returned to JVC to be reused.

Videotape is made by applying a coating of a magnetic material and a binder to a plastic backing. Iron, cobalt, nickel, and their alloys and oxides are substances typically used for recording applications.[1] Advanced magnetic recording media consist of thin films made of alloys of chromium, phosphorus, aluminum, copper, vanadium, and other metals.[2]

The first of two site visits at the McGraw Center to evaluate whether a health risk was associated with handling waste videotape was made on December 1 and 2, 1999. After a tour of the work area, a meeting with McGraw Center management was held to describe the NIOSH health hazard evaluation program and to discuss the activities planned for the site visit. To evaluate whether workers were exposed to metals, we used Wash'nDri® towelettes to wipe residues from varying lengths of two types of videotape, one having a shiny surface (three samples) and the other having a dull surface (two samples). Also, four workers agreed to wear light–weight sampling gloves while removing waste videotape from plastic hubs. Each worker wore sampling gloves for approximately 2 hours of a 6–hour work shift.

Five wipe samples and a sampling glove were submitted to the NIOSH laboratory in Cincinnati, Ohio, for trace metals analysis by inductively coupled plasma atomic emission spectroscopy (ICP–AES). The sampling glove submitted was the only one that visually appeared to have enough dust on it to warrant analysis. The worker who wore the glove did his job one–handed because of a physical disability, and consequently, one glove rather than a pair was submitted for analysis.

The findings of the first site visit were reported to you in a letter dated February 24, 2000. Iron was found in the greatest quantity on the sampling glove (8700 micrograms). According to JVC's material safety data sheet dated June 2, 2000, the black iron oxide used to manufacture their videotape consists of 90.5% magnetite (Fe_3O_4 or tri–*iron* tetraoxide), 6.5% carbon, 1.8% cobalt, and 1.2% silica. Thus, the finding that iron was the prominent substance on the glove was not surprising. While skin exposure to iron dust is of little health consequence, an important finding was the presence of measurable amounts of cobalt (260 micrograms) and nickel (5 micrograms) on the glove. Skin exposures to these metals may cause allergic contact dermatitis in sensitized people.[3,4]

Allergic contact dermatitis is a type IV delayed, or cell–mediated, immunological reaction caused by skin contact with certain chemicals, metallic salts, plants, or other sensitizing agents.[5–7] The resulting acute inflammatory response is characterized by erythema (redness), papules (bumps), and small (1 to 3 millimeters) vesicles (blisters). Stinging, burning, and itching may accompany the rash. With chronic exposure, thickened skin that is scaling or shiny on the surface can occur with cracking and fissuring at sites where the skin is stretched by motion.[5] Once a person is sensitized, skin contact with even a very small amount of the offending agent may cause an allergic reaction.[8]

Nickel

Although nickel is not a component of JVC's black iron oxide, it is found in mineral ores in combination with cobalt, arsenic, copper and other metals, and during the manufacture of metal alloys, it is essentially impossible to separate them completely.[4] Also, JVC may blend other sources of cobalt, nickel, and other metal additives with black iron oxide to manufacture its videotape.

Nickel is one of the most common contact allergens.[4] Although many workers may have nickel sensitivity, published research has shown that skin contact with nickel–releasing materials at work is an unlikely cause of nickel sensitivity.[4,9] Rather, nickel sensitivity of most people has been caused by domestic products worn in direct, prolonged contact with skin, such as earrings, necklaces, wristwatch cases, watch straps, and zippers.[4] The amount of nickel released by an object that will cause a skin reaction in a person having nickel sensitivity depends on many factors. However, while avoiding contact with nickel–containing objects is the only certain way to prevent recurrence of nickel dermatitis, a nickel release rate of 0.5 micrograms per square centimeter ($\mu g/cm^2$) per week or less has been reported as being generally considered safe for most sensitized people.[4] This release rate is also the legal limit in Europe allowed for

ear–piercing equipment and jewelry; the European legislation was enacted to prevent people from being sensitized to nickel and to protect those already sensitized.[4]

Cobalt

Domestic exposures to cobalt–containing materials are rare, and thus, allergic contact dermatitis caused by cobalt exposure occurs much less frequently than is caused by nickel exposure.[4] Researchers who examined and patch tested 853 hard metal workers reported that those workers having simultaneous nickel and cobalt sensitivity had more severe hand eczema than those having isolated cobalt or nickel sensitivity, or irritant dermatitis only.[9]

Soft magnetic alloys of cobalt and iron consisting of either 24 percent or 49 percent cobalt have been reported as likely to behave the same as cobalt or nickel metal regarding their abilities to cause contact allergic dermatitis.[4] Compared to these magnetic alloys, the percentage of cobalt in the black iron oxide used to manufacture JVC videotape (1.8 percent) is much lower. Consequently, workers handling JVC's videotape are likely to have a lower risk of experiencing contact allergic dermatitis from cobalt exposure. A release rate has not been recommended for cobalt.

Observations and sampling activities of second site visit

During the second NIOSH site visit made on February 7 and 8, 2001, I observed that most of the workers handling waste videotape were wearing thin, disposable gloves made of natural rubber latex. At break times and at the end of a work shift, workers removed their gloves and put them in a box in the pre–vocational work area. Before returning to work, most workers donned gloves drawn at random from the box of used gloves.

Sampling methods

Four workers wore sampling gloves for two hours while handling waste videotape. Unfortunately, a problem occurred at the NIOSH laboratory when the gloves were being processed, and the samples were destroyed before they could be analyzed.

Personal air sampling was done in the pre–vocational work area to evaluate whether an inhalation risk to cobalt was associated with handling waste videotape. In addition to posing a possible dermatitis risk, some of the metals found on the sampling glove collected during the first site visit may cause health problems if they are breathed. Of particular concern, exposures to air concentrations of cobalt exceeding occupational exposure criteria may cause respiratory disease (e.g., asthma and pulmonary fibrosis) and pulmonary sensitization.[3,10]

Four workers wore personal air sampling trains for 160 minutes while handling waste videotape. Each air sampling train consisted of an air sampling pump operating at 3.0 liters per minute that was connected by flexible tubing to a 37–millimeter cassette. Each cassette contained a 0.8–micrometer pore size, cellulose ester membrane filter and a backup pad. Air samples and field blanks were submitted to the NIOSH laboratory in Cincinnati, Ohio, for trace metals analysis by ICP–AES using NIOSH method 7300.[11]

Air sampling results were compared to the permissible exposure limit (PEL) for cobalt established by the Occupational Safety and Health Administration (OSHA), the recommended exposure limit (REL) of NIOSH, and the threshold limit value® (TLV®) of the American Conference of Governmental Industrial Hygienists (ACGIH®). The OSHA PEL of cobalt is an 8–hour time–weighted average (TWA) of 100 micrograms per cubic meter of sampled air ($\mu g/m^3$), the NIOSH REL is 50 $\mu g/m^3$ for up to a 10–hour workday, and the ACGIH TLV is an 8–hour TWA of 20 $\mu g/m^3$.[10,12–15]

In addition to the air sampling done during the second site visit, wipe samples were collected for metals analysis. A fifty–foot section of JVC videotape was wiped with a Wash'nDri® towelette (Softsoap Enterprises Inc., Chaska, MN), and another section of the same length was wiped with a Ghost™ Wipe (Environmental Express, Mt. Pleasant, SC). Also, five of the ten work tables in the pre–vocational work area were evaluated for metal contamination by wiping 100 square centimeters (cm^2) with Wash'nDri® towelettes and Ghost™ Wipes. A 100–cm^2 area of the table in the McGraw Center's conference room was also wiped to evaluate whether videotape dust may have migrated into the room from the adjacent pre–vocational work area. I wore disposable gloves made of nitrile when collecting all wipe samples and changed gloves between samples. Wipe samples and field blanks were submitted to the NIOSH laboratory in Cincinnati, Ohio, for trace metals analysis by ICP–AES using NIOSH method 7300.[11]

There are no PELs, RELs, or TLVs for skin exposures; consequently, there are no occupational exposure limits to which wipe sampling results can be compared. Many substances have "skin notations" attached to their airborne occupational exposure limits, but these notations are intended to identify only those chemicals for which skin absorption may add to a worker's overall exposure.[13]

Sampling results and discussion

Glove samplers have not been systematically tested for their retention efficiency, and thus, their accuracy is unknown.[8,16] However, the nickel release rate associated with handing waste videotape can be approximated by making the following assumptions:

- The sampling glove used during the first site visit captures and retains nickel in a manner similar to skin.
- The amount of nickel measured on the sampling glove during the first site visit (5 micrograms) is representative of the amount of nickel exposure of one hand for 2 hours of a 6–hour work shift. Thus, a worker using both hands while handling waste videotape

could be assumed to have an estimated exposure of 30 micrograms per day, or 150 micrograms per 5–day work week.

- The surface area of a worker's two hands (both palms and fingers) contacting waste videotape is approximately 400 cm^2.[17–19]

Using the above assumptions, the nickel release rate to which workers at the McGraw Center may be exposed while handing waste videotape is approximately 0.4 $\mu g/cm^2$ per week. This estimated exposure is only slightly less than the release rate considered to be protective for people sensitized to nickel (0.5 $\mu g/cm^2$ per week).

The airborne concentrations of cobalt measured were 0.4 $\mu g/m^3$, 1 $\mu g/m^3$, 2 $\mu g/m^3$, and 6 $\mu g/m^3$. All of these exposure estimates are less than cobalt's most protective occupational exposure limit, the ACGIH TLV 8–hour TWA of 20 $\mu g/m^3$.

The analytical results of the 50–foot lengths of videotape wiped with Wash'nDri® towelettes and Ghost™ Wipes are presented in Table 1. Cobalt was found on both wipes, but nickel was not found on either wipe, even though cobalt and nickel were found on a worker's sampling glove. Small amounts of nickel are found on videotape, and compared to what was wiped, the worker handled much more videotape during the 2–hour sampling period.

The amounts of some metals found on the Wash'nDri® towelette exceeded the levels found on the Ghost™ Wipe. For example, 95 micrograms of aluminum was found on the Wash'nDri® towelette, but 1.3 micrograms was found on the Ghost™ Wipe. Additional testing revealed that a characteristic difference between the two wipes (e.g., differences in texture or the wetting agent used) was the most likely reason for different amounts of aluminum being reported. The additional testing involved wiping 32 feet of videotape first with a Ghost™ Wipe, and then wiping it again with a Wash'nDri® towelette. Aluminum was not detected on the Ghost™ Wipe sample, but 280 micrograms was measured on the Wash'nDri® sample. Aluminum was not detected on the glove sample.

Exposure to fine powdered alumina dust has been reported to cause irritant contact dermatitis among workers employed in plants where alumina is processed. However, both domestic and occupational allergic sensitivity to aluminum is exceedingly rare, and most reported cases have been reactions to antiperspirants containing aluminum salts.[4] Thus, the possibility that a worker handling waste videotape could develop dermatitis from aluminum exposure is unlikely.

The analytical results of the work table wipes showed that the tables were contaminated with various metals and could be a source of skin exposure to cobalt and nickel. The results of wiping the conference room table resembled the background levels found on unused, field–blank wipes. This indicates that the conference room table was not contaminated and videotape dust had not migrated into the conference room.

Conclusions and recommendations

The sampling results of this health hazard evaluation have shown that the black, dusty material getting on the hands of workers handling videotape consists mostly of iron oxide. There are essentially no health hazards associated with skin exposures to this substance.

Glove and surface sampling found that workers handling waste videotape had risks of exposure to cobalt and nickel. However, a definite conclusion cannot be made regarding whether skin exposures to these metals are sufficient to cause allergic contact dermatitis in a sensitized person. Therefore, as with other occupational exposures for which knowledge is incomplete and for which workers have exposures to substances that may cause adverse health effects, good occupational health practices prescribe that consideration be given to minimizing exposures by using engineering or administrative controls, or by providing workers with appropriate personal protective equipment.

To help guide selection of protective measures before placing a worker in a job involving skin contact with waste videotape, the person, or the person's parent or legal guardian should be questioned about whether the worker has a medical history of sensitization to cobalt or nickel. Decisions affecting sensitized persons, should be made with input from a physician experienced with occupational skin diseases. For some sensitized workers, the best method of preventing contact allergic dermatitis may be avoiding all contact with waste videotape. In these cases, the worker should be assigned to another job away from the pre–vocational work area.

Following the first NIOSH site visit, interim recommendations for reducing the risks of skin contact with videotape dust were provided in a letter dated February 24, 2000. The first recommendation was that mechanical methods of removing videotape from hubs should be explored. If a determination that skin contact with videotape was unavoidable, a recommendation was made that workers wear either disposable cotton gloves or light–weight, chemical resistant gloves made of nitrile or vinyl. Another recommendation was that workers should be taught how to don, remove, and dispose of their gloves correctly and to wash their hands after removing gloves. For workers who could not wear gloves because of a physical impairment, a recommendation was made that they be assigned to tasks not involving hand contact with videotape.

The interim recommendation that mechanical methods be explored is still appropriate. Also, because surface–wipe sampling showed that work tables in the pre–vocational work area were contaminated with videotape dust, the tables should be cleaned regularly. In addition, supervisors in the pre–vocational work area should be vigilant about checking the skin of workers handling waste videotape to ensure that adverse health effects are not occurring. Skin rashes or other skin problems should be evaluated by a physician experienced with skin diseases.

The recommendations concerning protective gloves in my interim letter are revised as follows:

- Light weight, disposable, chemical–resistant gloves (e.g., gloves made of nitrile or vinyl) should be made available for *voluntary* use by McGraw Center workers who do not have nickel or cobalt sensitivity.

- Wearing latex gloves can cause irritant contact dermatitis, allergic contact dermatitis, and latex allergy, and thus, NIOSH recommends that only *nonlatex* gloves be used for work activities that are not likely to involve contact with infectious materials.[20]

- Light–weight cotton gloves should still be available for workers to use, but they should only be worn underneath chemical–resistant gloves to help reduce the discomfort that people may experience when their hands sweat inside chemical–resistant gloves.

- For most occupational situations where gloves are worn, wearing chemical–resistant gloves is recommended for protecting healthy skin and preventing new cases of contact dermatitis.[7,21] Because wearing chemical–resistant gloves can aggravate dermatitis once it has occurred,[7,21] their use by workers already having dermatitis may not always be appropriate. The medical treatment of workers having dermatitis and decisions about their use of personal protective measures should be supervised by a physician experienced with occupational skin diseases.[7] For some workers, the person responsible for making decisions on a worker's behalf (e.g., a parent or legal guardian) should also be involved in this decision-making process.[22]

- No disposable chemical–resistant glove that has become contaminated should be reused, but rather, it should be discarded immediately after being removed.

- To prevent secondary exposures, surfaces of chemical–resistant gloves that have been contaminated with videotape dust should be washed with soap and water and rinsed with water before the gloves are removed and discarded.

The following recommendations are for workers who do *not* have cobalt or nickel sensitivity and choose *not* to wear gloves. Prolonged skin contact is known to be an important factor in the development of cobalt and nickel sensitization, and compliance with the measures described below will prevent a worker from having continuous, long–term skin contact with videotape dust.

- After every work break and at the end of each work shift, a worker should wash his or her hands with mild soap, rinse with water, and dry them with disposable towels. Some workers may also need to wash their faces, especially if they frequently touch their face.

- Hand cleansers called "waterless soaps" are emulsions of oil–based chemicals and should be avoided because of their harshness.[23] Frequent use of waterless cleansers will dry the skin, and an eczematous dermatitis may occur.[24]

- Repeated hand washing, even with good–quality cleansers, can cause dry skin. Thus, skin moisturizing lotions or creams should be available for workers to maintain good skin hygiene. Because cream on the hands of workers handling waste videotape may increase the amount of dust adhering to their skin and increase their risk for dermatitis, skin lotions or creams should be applied only at the end of a work shift.

This letter represents the final report for NIOSH health hazard evaluation 2000–0043. To comply with NIOSH regulations requiring that employees be informed about the findings of a health hazard evaluation, please post this letter in a prominent location accessible to all affected employees for at least 30 calendar days. Parents and legal guardians of workers handling waste videotape should also be informed of the findings and recommendations of this evaluation. Therefore, please communicate with these people that you received this letter, where it is posted, and how they can obtain a copy. If there any questions concerning the information in this letter, or if we can be of assistance with any other occupational health issue, please call me at (513) 841–4227.

Sincerely yours,

Steven W. Lenhart, CIH
Industrial Hygienist
Industrial Hygiene Section
Hazard Evaluations and Technical
Assistance Branch
Division of Surveillance, Hazard
Evaluations and Field Studies

cc:
Mr. Pekera (JVC America)

Table 1. Wipe Sampling Results (micrograms) – VCR Tape

The Arc of Tuscaloosa County
Tuscaloosa, Alabama
HETA 2000–0043

	Wash n' Dri			Ghost Wipe		
Metal[1]	Wash n'Dri[2]	Blank[3]	Difference	Ghost Wipe[2]	Blank[3]	Difference
Aluminum	422	327	95	5.2	3.9	1.3
Barium	0.85	0.81	—	0.09	0.06	—
Cobalt	4.9	0.005	4.9	3.4	0.005	3.4
Copper	0.37	0.27	—	0.98	1.1	—
Iron	24	9.2	15	10	4.9	5.1
Potassium	43	29	14	74	99	—
Magnesium	170	160	10	100	110	—
Manganese	1.8	1.2	—	0.22	0.09	—
Phosphorus	6.9	1.4	5.5	34	52	—
Strontium	2.8	2.1	—	0.96	0.34	—
Titanium	9.8	0.31	9.5	0.30	0.04	—
Zinc	32	33	—	7.9	8.5	—

Note 1: Metals found on samples at a mass of 1 microgram or more.
Note 2: Greater value of two 50–foot wipe samples.
Note 3: Average of two blanks.

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DEPARTMENT OF HEALTH & HUMAN SERVICES Public Health Service

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September 7, 2001
HETA 2001-0233

Denise E. Hall, D.V.M.
United States Department of Agriculture
USDA/APHIS/VS/CEAH
5555 South Howes
Fort Collins, Colorado 80521

Dear Dr. Hall:

In May 2001, the National Institute for Occupational Safety and Health (NIOSH) received your request for a health hazard evaluation regarding potential occupational health risks among United States Department of Agriculture's Animal and Plant Health Inspection Service (USDA/APHIS) employees and other workers participating in a survey to assess the prevalence of scrapie disease among sheep in the United States (U.S.).

On June 25-26, 2001, NIOSH representatives made a site visit to the Purdue University Animal Disease Diagnostic Lab, West Lafayette, Indiana, to observe work practices of employees participating in the Scrapie: Ovine Slaughter Surveillance (SOSS) study and to discuss issues related to the HHE with USDA employees and others involved with the study. A visit was also made to a participating sheep slaughterhouse to observe collection of sheep heads by USDA employees. This letter presents the findings and recommendations from the NIOSH evaluation.

Background

Scrapie, a transmissible spongiform encephalopathy (TSE) of sheep and goats, is a fatal neurological disease that has been reported in many countries and recognized in Europe for over 250 years. The first case of scrapie diagnosed in the U.S. was in 1947.[1] Since 1992, surveillance for scrapie disease in the U.S. has been done primarily through the USDA's voluntary Scrapie Flock Certification Program. To date, over 1000 flocks have been involved, and approximately 1600 cases of scrapie in sheep, and 7 cases in goats, have been reported in the U.S. Though the assumed prevalence of scrapie among sheep in this country is 0.07%, there are no current data to support this estimate. Because its presence in the U.S. sheep population has serious economic consequences, the U.S. sheep industry asked USDA for assistance in eradicating scrapie. Emergency funding from Congress has been provided to assist in these efforts.

USDA recently initiated an accelerated scrapie eradication program. One component of that program includes a study to establish the national prevalence rate of ovine scrapie disease. The SOSS study is taking place in at least 14 states and involves approximately 25 mature sheep

slaughter plants and one export market. Because there is presently no acceptable live animal test for scrapie, confirmation of infection is done by immunohistochemistry on tissues taken from the heads of dead animals. Phase I of the study is ongoing. During this phase, field employees are collecting approximately ten sheep heads per month from participating facilities to test the collection, sampling, shipping, and analytical processes, and identify issues that must be addressed prior to Phase II, when the full study commences. Approximately 15,000 sheep heads will be collected during Phase II over a period of about one year. It is expected that approximately 30 to 50 individuals will be involved with sample collection, potentially including some temporary employees.

Methods

On June 25, 2001, NIOSH investigators met with you, health and safety representatives from USDA headquarters, USDA field personnel responsible for collecting Phase I specimens, and the Director of the Animal Disease Diagnostic Lab (ADDL) to discuss issues related to the study and the HHE request. At the ADDL, NIOSH investigators observed the collection of tissue specimens from sheep heads that had been obtained from a participating sheep slaughterhouse. On June 26, 2001, we visited a slaughterhouse to observe the head collection process, then returned to the lab to observe additional tissue sample collection from fresh heads and the use of a newly-acquired water extraction tool.

Portions of the USDA/APHIS Safety and Health Manual pertaining to medical monitoring and surveillance were reviewed as were the draft guidelines prepared by SOSS study personnel for reducing employee exposures to potentially infectious materials during tissue prosection.

Review of the Literature

Scrapie and other TSEs

Transmissible spongiform encephalopathies are fatal neurological diseases that occur in humans and certain animal species. Current theory is that normal proteins are converted into abnormally folded proteins, called prions, which are capable of causing disease. TSEs are characterized by the presence of microscopic, sponge-like holes and deposition of prion protein in the grey matter of the brain.[2] The causes of the abnormal folding, and factors affecting transmission of TSEs, are poorly understood.

Scrapie is an animal TSE naturally affecting sheep and goats; it has been transmitted experimentally to several animal species, including hamsters, mice, rats, voles, gerbils, mink, cattle, and some species of monkeys, by inoculation.[1] Natural scrapie is thought to be primarily spread through fluid and tissue from the placentas of infected sheep to lambs being born, or to other lambs in the area. However, the exact mode of transmission is not known. Signs of the disease are usually evident two to five years after the animal has become infected, but have

appeared much later in some animals. Once clinical signs appear, the sheep will generally die within a matter of months. Although scrapie can be transmitted to several animal species experimentally (such as through intra-ocular and intracerebral inoculations with infected tissues) as well as accidentally (through contaminated vaccines), there have not been any documented cases worldwide of ovine scrapie disease being transmitted to humans. Fact sheets prepared by USDA and the Canadian Food Inspection Agency indicate that there is no scientific evidence that scrapie poses a risk to human health.[1,3] Existing guidelines for preventing the spread of scrapie focus on animal-to-animal spread of the disease, but also include guidelines designed to keep diseased animals out of the human food chain.

In contrast to scrapie, there is evidence to suggest that other TSEs, such as bovine spongiform encephalopathy (BSE), can be transmitted to humans. BSE is thought to be primarily a disease of cattle. BSE is also thought to be the most likely cause of variant Creutzfeldt-Jakob disease (vCJD), a fatal human disease that has been implicated in over 100 deaths in the United Kingdom.[4] BSE was first recognized in Great Britain in1986, and has not been diagnosed in native cattle outside Europe. BSE is believed to have resulted from feeding cattle meat and bone meal (MBM) made from sheep infected with scrapie.[5] BSE has been experimentally transmitted to sheep; sheep infected with BSE exhibit the same signs as sheep infected with scrapie. It is not known what risk BSE infection in sheep (from a bovine-adapted scrapie agent) may pose to humans. Current tests used to differentiate scrapie from BSE take years to complete.

Although there remain uncertainties about possible routes of exposure to TSEs in general, there is no evidence that any of the TSE agents are transmissible by the airborne route.[6] TSEs are thought to be transmitted by the oral route (concerning scrapie and sheep, through ingestion of infected animal feeds; concerning BSE and human illness, through the ingestion of infected bovine tissue). TSEs have also been transmitted to animals experimentally via inoculation with infected tissues, and accidentally (concerning CJD to humans) via contaminated medical instruments or contaminated pituitary hormones. Guidelines concerning TSE transmission from animals to humans are available from the United Kingdom.[7] These guidelines group the TSEs together, but do note that there is no evidence of transmission of scrapie to humans.

Surveillance for BSE in the U.S. is coordinated by USDA/APHIS. When notified of a condemned animal, Foreign Animal Disease Diagnosticians are called in to sample the brain of the dead animal either on-site or at an off-site facility such as a veterinary diagnostic laboratory. Through mid-July 2001, nearly 14,000 bovine brains had been examined for BSE or another form of a TSE in cattle using histologic examination and immunohistochemistry, and there have been no positive samples found.[8]

Zoonoses Associated with Sheep

Sheep, as with other livestock, are susceptible to infection with a number of organisms which have the potential to cause disease in humans; some of those are the organisms causing Q fever, brucellosis, leptospirosis, rabies, Orf, and anthrax. Of particular concern among workers exposed to sheep is Q fever.

Q fever is caused by the rickettsial organism, *Coxiella burnetti*, which is found in the highest numbers in the placenta, birth tissues, and amniotic fluids of infected cattle, sheep, and goats. The organisms have also been found in other tissues such as the liver, spleen, brain, adrenal glands, lungs, kidneys, heart, lymph nodes, intestinal tract, mammary gland, and skin.[9] Transmission of Q fever to humans is possible by several routes; it is usually acquired through inhalation of infectious aerosols.[10] The aerosols may be generated by infected animals, placental tissues and fluids, waste products, and contaminated straw or bedding.[11] The organisms are considered highly resistant to dessication, and can survive for extended periods of time in the environment.[12] The incubation period ranges from 7 to 40 days, depending on the route of exposure and dose.[9] It is known that small numbers of organisms can transmit the infection. The infectious dose by inhalation [ID_{25-50}] is 10 organisms.[13] Human infection can cause a variety of clinical manifestations; about one-half of all people infected with *C. burnetii* show signs of clinical illness. Symptoms of acute Q fever include chills, high fever, headache, muscular pain, fatigue, anorexia, chest pain, cough, and abdominal pain. Chronic Q fever may involve endocarditis or hepatitis.[14] The chronic form, characterized by infection that persists for more than six months, is uncommon, but is a much more serious disease than acute Q fever. Most patients who develop chronic Q fever have pre-existing valvular heart disease, a history of a vascular graft, or immunosuppression. Exposure to sheep and their birth products is a known occupational hazard in facilities using sheep as research animals.[15] Q fever has been documented among workers at a sheep abattoir performing a variety of jobs in areas throughout the plant.[12] One study found the risk of Q fever related to contact with the farm environment, as opposed to any specific animal exposure.[16]

Findings and Observations

On June 25, 2001, we observed tissue collection from several sheep heads that had been obtained about one week earlier. The following tissues were obtained during the necropsies: obex of the medulla oblongata, dorsal spinal cord, tonsils, retropharyngeal lymph nodes, and lymphoid tissue from third eyelids. This work was done by two individuals, one who extracted the brain and collected the tissues, and another who labeled the specimens, and placed them in cassettes or jars containing formalin prior to shipment to the National Veterinary Services Laboratory (NVSL). SOSS study kits with specimen containers, formalin solutions, and labels were provided to the employees with sufficient supplies for sampling ten heads. The brain extractions were performed using the 'scoop method,' which involves a scoop tool that is slightly bent near the tip of the blade. The individual performing the tissue collection wore disposable Tyvek® coveralls,

plastic shoe coverings, face shield, latex gloves, and surgical mask. The employee assisting with specimen processing wore a lab coat and, at times, gloves.

On June 26, 2001, we visited a mature sheep slaughterhouse in Indiana and observed the collection of 10 sheep heads. Slaughterhouse employees removed the heads and placed them on a table, and USDA employees put the heads in plastic bags, then placed them in a heavy plastic container that was covered for transport to the ADDL. The employee collecting the heads wore a Tyvek® suit, rubber boots, safety glasses, and gloves. At the laboratory, we observed tissue collection from 3 heads. We noted some procedural variations in the tissue collection on this day compared to the previous day. On June 26, a veterinarian from the ADDL assisted the USDA employee with this work. To facilitate sample collection, efforts were made to stabilize the head using a clamp, and the water extraction method was used to remove the brain. This method involves the use of an extraction tool which is a modified spray nozzle with about eight inches of copper tubing soldered to extend the nozzle. Although this was the first time the employee had used the new tool, the brain appeared to be easily extracted and there was no visible spray or splashing of fluid when the device was inserted into the head and the water released from the nozzle. Because the sheep heads were fresh, there was more body fluid associated with these heads than with those from the previous day. After each necropsy, the stainless steel table was sprayed with water to remove residual fluids and tissue. This process did create a visible aerosol/spray as did the rinsing of the employees' soiled gloves due to the pressure of water from the sink. We did not observe the final clean-up that day, but the draft protocol states that a 2% sodium hydroxide solution is to be used for surface decontamination (for a minimum of one hour) and for overnight soaking of contaminated utensils.

Employees participating in Phase I of the SOSS study have been given instructions concerning the types of tools that are to be used for specimen collection (#3 surgical blades, curved scissors, rat-tooth forceps, scoop tool and water extraction tool) and general guidance on use of personal protective equipment. Tissue collection from the sheep heads may be done at the slaughter facility or at a nearby veterinary lab. Employees have received training on tissue collection techniques via a CD-based training program developed by personnel at NVSL. The CD has video clips on tissue collection, slides of scrapie histopathology, the SOSS Study Operations and Necropsy Manual, safety and health recommendations, and equipment/supplies for the SOSS Study kits. The draft guidelines for reducing exposures to potentially infectious materials during tissue prosection include the recommendation to minimize the use of tools or equipment that may cause cuts, abrasions, or wounds, and in situations where this is unavoidable, to use personal protective equipment (Wellington boots or equivalent, disposable particulate respirators, cut-proof gloves worn over latex or rubber gloves, helmet [at slaughter plant], coveralls, and lab coat). Face protection (faceshield or equivalent) is also recommended.

Selected Aspects of the USDA APHIS Safety and Health Program

The USDA/APHIS Safety and Health Program is outlined in a manual dated February 27, 1998. The manual gives responsibility for establishing and maintaining an Occupational Medical Monitoring Program to senior line management at the regional, facility, emergency program, or special project level. Based on our discussions with persons involved with the SOSS study, there does not appear to be a uniform program for medical surveillance/monitoring or record-keeping for USDA/APHIS employees performing similar tasks in different regions of the country.

Discussion

Occupational health concerns for employees participating in the SOSS study include those related directly to the work tasks being performed (dissection of the sheep heads), and those related to the work environment(s) from which sheep heads are collected and in which the work tasks are performed. The current SOSS protocol calls for either tissue sample collection at the slaughterhouse or at a nearby veterinary laboratory.

Tissue Sampling Although there are many gaps in our understanding of scrapie and the agent which causes scrapie among sheep and goats, there is currently no evidence that scrapie of sheep and goats is transmitted to humans. However, several important related topics concerning scrapie and other TSEs have been raised recently. For example, it is known that sheep can be experimentally infected with the agent causing BSE, and concern has been raised that vCJD could possibly be caused by human exposure to BSE infected sheep. There has also been concern raised about the possibility of 'altered' forms of scrapie, which may possibly pose a health hazard for humans. These concerns remain theoretical as applied to the current questions raised in this HHE. At this time there is no reason to believe that the sheep being sampled as part of the SOSS study have an altered form of scrapie or some other TSE (such as BSE).

The extent of aerosolization of organisms which are known to be infectious by inhalation, such as *C. burnetti*, during the tissue sampling process from the sheep heads is unknown. Though brain tissues have been found to contain *C. burnetti*, and the organisms can be shed in oral and nasal secretions, the highest numbers of organisms are believed to be found in the placenta and other birth products at the time of parturition, and in the milk.[17] USDA employees would not likely contact birth tissues and fluids or milk during the course of the SOSS study. We are not able to quantify many of the factors involved in the tissue sampling process required to make an assessment of potential risk. Some of those factors include the prevalence of sheep infected with *C. burnetti* among those at the abattoirs, the specific procedure(s) used to perform the sampling (which may vary with time and by individual), and specific characteristics of the workplace where the samples are being collected. Overall, the work practices we observed during our site visit involved little potential for aerosol generation, with the exception of the cleaning process

which involved hosing the tables to remove surface contamination, and the rinsing of gloves. The sampling of tissues predominantly involves dissecting techniques with scalpels and scissors.

The primary method recommended by USDA staff for sampling brain tissue involves a brief application of water, under pressure from a hose connected to a faucet, within the sheep head to remove a portion of the brain. Although this procedure has the potential for generation of an aerosol or spray, on the day of observation, the use of water was brief and involved no visible aerosol or spray. It must be noted, however, that other employees might use the tool in a different manner, possibly creating excess spray or aerosol.

Work Environment The risk of Q fever for researchers and other workers in animal research laboratories has been documented in the medical literature. However, the laboratory work performed by workers participating in the SOSS study differs from that of workers described previously in that the SOSS workers are primarily sampling tissues from sheep heads, and are not working with live sheep in a research facility. Those employees participating in the SOSS study only by handling sheep heads in the laboratory setting are likely at less risk for inhalation of potentially infectious aerosols compared to those who are exposed to whole sheep in the research, farm, or abattoir setting.

Some workers participating in the SOSS study may be doing some or all of their work at sheep abattoirs. SOSS workers exposed to sheep in the abattoir environment are likely at some increased risk of Q fever, even if not involved directly with higher-risk exposures (such as exposure to birthing products or working with known infected animals). Because the prevalence of infection with *C. burnetti* among the sheep to which SOSS workers may be exposed is not known, and because specific work practices in abattoirs leading to the production of potentially infectious aerosols have not been characterized, it is difficult to determine the extent of this increased risk. The overall utility of respiratory protection against inhalation of aerosols containing *C. burnetti* in abattoirs is not known but would depend on many factors. Some of those factors include the likelihood of the presence of an aerosol-containing infectious material, and the concentration of infectious particles in the air. It is also important to note that although *C. burnetti* infection among healthy persons commonly causes an illness which resolves without therapy or is treatable with antibiotics, *C. burnetti* infection among persons with pre-existing valvular heart disease, a history of a vascular graft, or immunosuppression, can lead to a potentially life-threatening illness.

Other Potential Hazards. The use of sharp instruments presents a hazard for employees due to the possibility of injuries as well as exposure to potentially infectious material. Direct contact with sheep and sheep products (including wool) also presents a potential for exposure to zoonotic diseases (anthrax, orf, ringworm) and should be avoided. The use of cleaning agents and disinfectants that contain sodium hydroxide, sodium hypochlorite, and formaldehyde can result in eye and skin irritation if employees are not adequately protected.

Conclusions

USDA employees and others participating in the SOSS study have potential exposure to zoonotic agents, chemical substances, and physical hazards during the course of their work. Training and education of employees is needed to minimize these potential hazards. Though the risks cannot always be adequately quantitated, good occupational health practices prescribe that engineering and administrative controls and appropriate personal protective equipment (PPE) be used to minimize exposures. In addition, medical surveillance programs that complement these primary prevention efforts are needed to detect infection and disease at an early or subclinical stage, and to help monitor the effectiveness of the controls.

Recommendations

1. The draft guidelines for reducing occupational exposures during tissue prosection should be finalized (considering the recommendations made below), and then made available to all study participants and their supervisors. Participating employees should receive training that describes potential occupational hazards and risks, stresses the importance of timely reporting of all injuries and illnesses of suspected occupational origin, emphasizes the importance of receiving appropriate immunizations and screening tests, and provides a thorough review of proper PPE use and maintenance. Because employees will be located in at least 14 different states, we recommend that there be a forum (for example, through an e-mail list serve) for ongoing communication to discuss problems and concerns, and to share ideas between field employees, other study participants, and supervisory personnel.

2. When deciding where the tissue sampling will be done (at the slaughterhouse or in a laboratory), health and safety considerations unique to the sampling location should be considered. One important consideration should be that the chosen location have sufficient space for the employees to safely do the work, while minimizing exposure to potential workplace hazards not directly related to the tissue sampling (contact with live animals, trip and fall hazards, etc.). Information about these hazards should be reflected in the employee training program.

3. The following general work practices are recommended for SOSS employees:

    a. Eating, drinking, and smoking should not be done is work areas where animals or animal tissues and fluids are present.
    b. Unnecessary contact with live animals, tissues, and fluids should be avoided. Where this cannot be avoided, such as during the actual collection of sheep heads and during the necropsy procedure, protective clothing and equipment should be worn (as discussed in recommendation #4).
    c. The generation of aerosols should be minimized. The use of plastic-backed absorbent pads or sheets on the necropsy table should be considered to facilitate clean-up and

minimize the creation of aerosols or splatter during cleaning. Consideration should also be given to sampling the brain tissue while the head is in a clear plastic bag to reduce aerosolization and splatter that may occur while using the water extraction tool. This procedure has been recommended for autopsies of patients with suspected prion diseases.[18]

d. Hands and exposed skin should be washed before and after tissue sampling, and whenever gloves are removed.
e. Protective clothing and equipment should not be worn in the employees' vehicles or while eating. The clothing should be removed prior to leaving the work area or laboratory and disposed of properly.
f. Sharp objects (scapels, glass, etc.) should be disposed of in a sharps container.
g. Cuts or other injuries should be dealt with immediately by performing first aid, then reporting the incident to the supervisor.
h. Existing cuts, abrasions and skin lesions on exposed skin should be covered with waterproof dressings.

4. The recommended PPE should be clearly communicated to employees. A minimum level of PPE should be established and required for general tasks such as head collection and tissue sampling, with options for increasing the level of PPE for specific circumstances. Based on our observations and literature review, the following general PPE is suggested:

   a. Coveralls or a lab coat should be used to protect street clothes. Whenever possible, this should include the use of disposable garments to avoid the need for home laundering of soiled or potentially contaminated clothing. The draft protocol states that 2% chlorine should be used to wash protective clothing after each use. If `this refers to home laundering of protective clothing (for those employees who are not near a veterinary laboratory and will be doing the necropsies at the slaughter facility), the practicality of doing this in a home washing machine, for example, should be further evaluated. In addition, this concentration of chlorine (a 50:50 dilution of household bleach) may be destructive to some fabrics.
   b. Eye protection (safety glasses or goggles) should be worn. If the potential for splashing cannot be eliminated (for example, by use of a clear plastic bag when sampling brain tissue with the water extraction method), a face shield should be worn. Because face shields are considered secondary protectors and are only designed to provide limited protection to the face and front part of the neck, they should be worn over other protective eyewear.[19]
   c. Disposable gloves should be worn for all contact with animals, and animal tissues and fluids. Cut-resistant glove(s) can be worn under the disposable latex or rubber gloves when sharp instruments are used. Because thin latex or rubber gloves (such as surgical or exam gloves) may not provide sufficient protection against 2% sodium hypochlorite or 2M sodium hydroxide (specified in the draft protocol), heavy rubber

gloves or other suitable material should be available to employees who are cleaning and disinfecting surfaces.

d. Avoiding procedures that create aerosols and using appropriate work practices described above should obviate the need for respiratory protection. However, because some employees have indicated a desire to use a respirator (such as a disposable N95 particulate respirator) employees should be allowed to do so under the voluntary use provisions of the OSHA Respiratory Protection Standard.[20] Employees should discuss this with appropriate APHIS safety and health personnel.

e. Additional PPE requirements specific for work in the participating slaughterhouses and laboratories should be determined and provided to the employees (hard hat, rubber boots vs. disposable shoe coverings, use of disinfecting foot baths, lab coats over coveralls, etc.).

5. A uniform occupational safety and health program should be established for all workers participating in the SOSS study. This program should be managed by an occupational safety and health professional within APHIS (the 'Program Manager'), and should apply to workers participating in SOSS from all areas of the country. Supervisory personnel in the field, including the Occupational Medical Monitoring Program Coordinators referred to in the APHIS Safety and Health Manual, should be responsible for reporting all relevant information concerning the safety and health program to the Program Manager. Among other things, having a central Program Manager will allow for consistent implementation of safety and health policies and improved surveillance of potential occupational health problems among these employees.

   a. Because most SOSS employees likely have other duties involving potential occupational exposures, recommended elements of a safety and health program for any specific employee will have to take into account all of the work duties of that employee. This will require coordination between the Program Manager, supervisory staff in the field, and the employees. The determination of specific components to be included in the safety and health program for SOSS employees should be made by the Program Manager. Much of the current USDA APHIS Occupational Health Program (Chapter 7, APHIS Safety and Health Manual) may be adapted for this purpose. However, certain aspects of the current Occupational Health Program should be reviewed to consider whether those guidelines are applicable to SOSS workers. For example, although brucellosis has been a potential hazard among those working with sheep in the past, current data concerning brucellosis eradication should be reviewed to determine whether this currently remains an important occupational health problem for SOSS employees. Comments concerning specific issues raised during this HHE are included below.

   b. All personnel who potentially will come into contact with sheep or sheep products (including for example, excrement or birth products) at farms, abattoirs, research

facilities, or other facilities should be considered at increased risk of exposure to *Coxiella burnetti* and should be included in a medical surveillance and education program for Q fever. Specific components of a medical surveillance and education program for Q fever include baseline and periodic serum samples for Q fever antibody status.[15] Education concerning Q fever for this type of program should include information about transmission, clinical illness, risk factors for severe illness, and treatment. Information already prepared by the USDA and CDC may be useful as educational tools. An investigational vaccine for Q fever has been developed but is not widely available;[21] USDA management should contact the Special Immunizations Program, U.S. Army Medical Research Institute for Infectious Diseases [USAMRIID], Fort Detrick, Maryland, to determine its availability and usefulness for USDA employees.

1. Information collected as part of the medical surveillance program should be collected and reviewed in a systematic manner by the Program Manager. Systematic review may be helpful in determining the most useful aspects of the medical surveillance program and in determining the extent of risk of infection with *C. burnetti* among SOSS workers. The periodic review should help assess the effectiveness of existing controls and the need for any modifications in the protocol.

2. Those persons judged to be at increased risk for severe infection with *C. burnetti*, such as persons with valvular heart disease, vascular grafts, or immunosuppression, should be counseled regarding potential increased risks. A decision to work in an environment such as an abbatoir where there is likely some increased risk of infection, should be made in consultation with the individuals' healthcare provider. At a minimum, such employees should use respiratory protection while at the abbatoir, and the respirator should be used within the context of a complete respiratory protection program.[20] APHIS safety and health personnel should be contacted regarding the type of protection to be used and enrollment in the APHIS Respiratory Protection Program.

c. Rabies pre-exposure prophylaxis should be provided to SOSS employees as recommended by CDC;[22] SOSS personnel should also be up to date on tetanus and diphtheria immunization.[23]

This report will serve to close out the file for this HHE. In accordance with NIOSH regulations, a copy of this letter should be posted in an area accessible to the affected employees for a period of at least 30 days. Also enclosed with this report are multiple colored copies of a document entitled, "Highlights of the NIOSH Health Hazard Evaluation." These highlight documents outline the findings of this evaluation in a clear-to-read format and should also be posted in

places accessible to the affected employees. If you have any questions, please do not hesitate to contact us at (513) 841-4597 (Ms. Seitz) or (513) 841-4558 (Dr. Trout).

Sincerely yours,

Teresa A. Seitz, MPH, CIH
Industrial Hygienist

Douglas Trout, MD, MHS
Medical Officer
Hazard Evaluations and Technical Assistance Branch
Division of Surveillance, Hazard Evaluations and Field Studies

cc:
P. Petch, APHIS/H&S
R. Osborne, APHIS/H&S
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DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

Copy

National Institute for Occupational Safety and Health
Robert A. Taft Laboratories
4676 Columbia Parkway
Cincinnati OH 45226-1998

October 31, 2003
HETA 2004-0031

Sandy Gross
ERT-B Safety Manager
FEMA Disaster Field Office
7800 Carousel Lane
Richmond, VA 23294

Dear Ms. Gross:

Enclosed is the final report for the National Institute for Occupational Safety and Health (NIOSH) technical assistance visit to the Federal Emergency Management Agency (FEMA) in Richmond, Virginia. The report provides a summary of observations, findings, and recommendations resulting from walk-through inspections at various locations throughout the disaster area, and discussions with FEMA managers and employees. Because our observations were limited to relatively few locations and interviews, this report cannot provide a comprehensive description of all hazards that may be encountered by FEMA response workers. Nevertheless, we believe that it identifies significant hazards and organizational issues affecting the safety and health of FEMA employees.

We hope that you will find this information to be helpful. If you have any questions, please contact David Sylvain at (508)997-6126 or dcs3@cdc.gov; or Ann Krake at (513)841-4206 or amk3@cdc.gov.

Sincerely yours,

David C. Sylvain, CIH
Industrial Hygienist
Regional Industrial Hygienist
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Enclosure

bcc: Scott Deitchman
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HETA 2004-0031

HETA 20040042
NIOSH Technical Assistance Report
October 31, 2003

Federal Emergency Management Agency
Response to Hurricane Isabel
Richmond, Virginia

David C. Sylvain, CIH
Ann M. Krake, MS, REHS

Introduction

On September 18, 2003, Hurricane Isabel made landfall in North Carolina as a Category 2 hurricane. Isabel continued northwest through Virginia, losing intensity as the storm moved inland. Virginia experienced wind damage and flooding, resulting in a Presidential disaster declaration on September 18. The list of declared counties eventually included all counties east of and including Bedford County, and encompassed approximately two-thirds of, or 99 counties, in the State of Virginia alone. The most heavily damaged areas were along the eastern shore, where tidal surge and the strongest winds occurred.

On September 23, 2003, the National Institute for Occupational Safety and Health (NIOSH) deployed two industrial hygienists to the Federal Emergency Management Agency (FEMA) Initial Operating Facility (IOF) in Richmond, Virginia. The deployment was initiated in response to a request for assistance in developing an occupational hazard database for FEMA response workers. Toward this end, the NIOSH investigators were asked to identify potential hazards, recommend controls and personal protective equipment (PPE), and identify training needs for FEMA field employees. The request identified the following job categories as priorities for this hazard evaluation:

Rapid Needs Assessment
Preliminary Damage Assessment
Public Assessment
Individual Assessment
Mobile Emergency Response Support
Community Relations
Debris Monitors
Security
Logistics
Mobilization Centers

Background

The majority of FEMA personnel are temporary employees known as Disaster Assistance Employees (DAEs). This workforce is largely comprised of older workers (retirees). DAEs are assigned to one of three teams which rotate through "on call" status. According to individuals on the various teams, DAEs comprise approximately 75 percent of the FEMA workforce at declared disasters. While on call, a team is subject to activation in the event that the President declares a disaster. Upon activation, team members work approximately 12 hours per day, 7 days per week for a minimum of 30 days. When in inactive status, DAEs are not involved in FEMA training and/or preparation for future responses.

Upon arriving at the IOF, NIOSH investigators met with Sandy Gross, Emergency Response Team - B (ERT-B) Safety Manager, to obtain information regarding FEMA response workers, the nature of work performed by the various teams, and health and safety issues. Following the meeting at the IOF, the NIOSH investigators identified those teams which were actively working in the field where they could be exposed to hazards. For teams which were not working in the field during the NIOSH visit, investigators conducted informal interviews to collect information about tasks, occupational hazards, and other pertinent information.

Observations, Findings, and Recommendations

Rapid Needs Assessment Team

Members of the Rapid Needs Assessment Team (RNA) conduct initial assessment(s) within the first few hours after an incident to determine the need for federal response to life-threatening situations and imminent hazards. The team is responsible for assessing both the overall impact of a disaster event and determining federal response requirements. Specifically, the RNA team is tasked with determining immediate victim needs (food, water, medical, shelter, etc.) and impact to infrastructure (utilities, communications, transportation, etc.). They also provide disaster intelligence concerning life-threatening situations and imminent hazards. The assessment data are then used by state and federal managers in making response decisions. The team is expected to complete their assignments within 24-72 hours. A team may be activated by FEMA and pre-positioned prior to a disaster in anticipation of a possible state request for assistance. This was the case for the team assigned to Hurricane Isabel.

According to the RNA Field Operations Guide (FOG), "team personnel will be exposed to many hazards during the initial hours following the arrival at a disaster scene. The team leader has the primary responsibility to ensure that good safety practices are maintained throughout the operation. Each team member must also recognize and practice safety procedures to ensure their individual as well as the team's welfare." (Page Green-2.) Team members are asked to wear the following PPE, which they are not provided: hard hat, laced leather boots with slip-resistant soles, gloves to protect hands, high-visibility protective vest, insect repellant when exposed to insect-infested environments, eye protection when in dusty environments, and hearing protection when working near high-noise level equipment such as helicopters.

Preliminary Damage Assessment Team

Members of Preliminary Damage Assessment (PDA) Teams are responsible for determining the amount of recovery assistance required by an affected state. It is these teams' responsibility to assess whether the damage is sufficient for a declaration of disaster. Early in the response, PDA teams, which are generally comprised of one state and one federal representative each, go into affected communities to assess damage to public infrastructure including utilities, sewers, dams, hospitals, roads, and bridges, and to determine the amount of debris clean-up that will be required.

Public Assessment Inspectors

Public Assessment (PA) inspectors usually travel in teams of two and include one FEMA representative and one state representative. The teams are responsible for meeting with the representatives of affected communities to bring information and advice to the public and local agencies and to make estimates of

the amount of resources needed for the damage that occurred. These meetings usually require that the PA team members inspect the 3-4 most heavily damaged locations in each county for verification.

Individual Assessment Inspectors

Most Individual Assessment (IA) inspectors are contractors, hired during the recovery phase of the incident, who go into each affected home to assess structural damage. Therefore, health and safety responsibilities lie with the contractor. However, during the response phase, most IAs are DAEs and their primary task is to identify the number of homes damaged or flooded in an assigned area. Usually they speak with home owners at established disaster response centers (DRCs), but may have to enter certain homes to assess the damage.

Mobile Emergency Response Support

Mobile Emergency Response Support (MERS) team members are responsible for establishing communications at incidents. If possible, they are positioned prior to an incident, as was the case for Hurricane Isabel. The team is responsible for driving mobile response vehicles equipped with satellite communications equipment into the center of a disaster and then establishing communications for use by the IOF and DFO personnel. They are also responsible for running the wires and installing the computers used in these locations. Most MERS team members are full-time FEMA employees and all are required to have commercial driver's licenses and follow Department of Transportation regulations.

Community Relations

Early in any response, Community Relations (CR) employees go into affected communities to bring information and advice to the public and local agencies. CR employees provide guidance to assist affected individuals and public entities in obtaining financial aid, water, ice, shelter, and other services provided by, or through, FEMA. CR functions as the eyes and ears of the Federal Coordinating Officer (FCO). CR employees observe the impact of the disaster and the needs of individuals/communities. CR employees obtain feedback from affected communities for the FCO to ensure the effectiveness of relief programs. At the time of the NIOSH visit, there were approximately 35 CR employees, with perhaps 10 more to be added at a later date. When visiting affected areas, DAEs are often paired-up with representatives from State Agencies. As is common throughout FEMA, all but a few CR employees are DAEs.

CR employees travel throughout affected areas to identify individuals and/or local entities who may benefit from FEMA assistance. CR workers commonly provide information during informal meetings or discussions with the public. These discussions do not require CR employees to enter or inspect damaged buildings. Nevertheless, a citizen may ask the CR employee, as a FEMA representative, to enter a home or other building to see damage and losses. It is at this time that CR employees may be exposed to a variety of hazards, in addition to those which may be present out-of-doors.

Debris Monitors

Approximately 24 Debris Monitors (DMs) oversee the disposal of "eligible" storm debris at reduction and collection sites throughout the disaster area. During this response, eligible debris consists of trees and woody debris that is collected and transported to disposal sites by contractors. The contractors, which are hired by local government entities, must conform to FEMA requirements in order for the local entities to receive reimbursement of disposal costs. Requirements include the type of debris, the location where obtained, and the volume of the loads which are received at the debris sites.

The primary function of DMs involves monitoring loads that arrive at debris disposal sites. At each site, a DM monitors the loads from an observation tower. The DM performs a visual inspection to ensure that trucks are fully loaded and that load tickets are correct. The observation towers are usually constructed of lumber or metal scaffolding. Indoor scissor lifts have been used on some sites in lieu of sturdier construction. During the site visit to the Hampton landfill, a scissor lift was observed which had been used for one or two days until the permanent tower was constructed. The permanent tower at the Hampton site, as well as the tower at the neighboring Poquoson site, was sturdy and stable. Although debris reduction sites may operate 24 hours per day, FEMA DMs are on duty during daylight hours only.

Heavy truck traffic can be expected at disposal sites. A steady flow of trucks arrive, pass by the tower, are unloaded, and then depart to get another load. Workers, including FEMA DMs, are exposed to truck traffic whenever they are on ground-level near the road. Trucks, passing within close proximity to observation towers, have been reported to have hit the towers, as well as exposing persons on the tower to branches which may hang over the sides of the trucks. Persons in the vicinity of unloading operations will be exposed to various types of heavy equipment, such as excavators, bulldozers, and backhoes.

Debris reduction is commonly accomplished by burning, chipping, or grinding. Burning occurs in a forced-air burn pit which is dug by a contractor (not FEMA). The burn pit is approximately 10 feet wide, 40 feet long, and 15 feet deep. A trailer-mounted diesel-powered air curtain blows air across the face of the pit, which results in less smoke and a cleaner burn. Debris is added to the fire using an excavator equipped with a grapple, or other similar equipment. By controlling the feed rate (i.e., not overfeeding the fire), smoke can be controlled to some extent. The burn pit will eventually fill with ash, and/or the sides will start to collapse. At this point, the pit must be shut-down for cleaning or reconstruction elsewhere on the site.

Trailer-mounted chippers and tub grinders are being used at various sites. Associated hazards include moving mechanical parts, wood chips (eye hazard), and projectiles thrown by tub grinders.

Although it appears to be uncommon, propane tanks and containers of unknown or hazardous materials may be mixed in with debris. These materials should be separated from the debris stream, and the appropriate state agency is called to assist with hazardous items.

It was reported that an order had been submitted for personal protective equipment (PPE) including visibility vests, leather gloves, hard hats, steel-toed footwear, insect repellent (DEET), and drinking water. This equipment had not arrived prior to the deployment of DMs to debris sites.

Security

FEMA Security staff are responsible for providing security and protection for Federal personnel and property in disaster areas. The focus of FEMA Security is on field offices and the DFO; however, security personnel will go wherever assigned by headquarters. Immediately following the incident, security personnel conduct physical security surveys in buildings to be used for the Federal response. During surveys, Security depends upon the survey team's safety officer to identify safety and health hazards. Other responsibilities are similar to those of law enforcement officers, such as control of building access, detention of individuals, assisting the injured, and preserving evidence. It was reported that bloodborne pathogens (BBP) training is provided by FEMA headquarters.

Logistics and Mobilization Centers

Logistics personnel set up the IOF and DFO, and support response activities. Their tasks are a mix of managing logistics and physical labor. According to employee interviews, logistics personnel unload trucks, lift boxes, and move loaded pallets using pallet jacks. Although not observed at the DFO, it was reported that logistics staff operate forklifts as needed. It was reported that at least some logistics employees have not received forklift training. According to logistics staff, lifting is the primary occupational hazard. Workers experience physical demands associated with bending, lifting, and moving furniture, boxes, pallets, tables, and all of the items that are needed to support a response. It was reported that due to understaffing, logistics staff must work 14 hours per day for several weeks during the early phases of a response, which results in stress and fatigue. Steel-toed footwear are not required or provided where workers are handling pallets and other heavy items.

A Mobilization Center serves as a staging area for supplies and equipment which will be distributed to affected locations. For this response, the Fort Eustis Mobilization Center served as a staging area for bottled water, ice, and electric generators. The Mobilization Center operates 24 hours/day, 7 days/week. The U.S. Forest Service (USFS) had been mission-assigned to ship water and ice to distribution centers where they were distributed to the public. Occupational safety and health for the USFS is supervised by an onsite safety officer. According to the USFS safety officer, only minimal lifting is required at this Mobilization Center; USFS personnel inspect loads and supervise contractors who operate forklifts. It was reported that most loads remain on the tractor trailers until arrival at a distribution center. Very little forklift activity was observed during the NIOSH site visit. Large industrial electric generators were distributed by the Army Corp of Engineers. A large lift truck is used to load/unload generators from flat bed trailers.

A site safety plan had been developed and signed by the management team at the Fort Eustis Mobilization Center. The team was comprised of representatives from FEMA, USFS, the General Services Administration (GSA), and the Army Corp of Engineers. Items identified in the safety plan included material handling, night operations, and office safety. Forklift training is required of all contractor personnel who operate powered industrial trucks. A FEMA Disaster Safety and Health Officer had been assigned to the Fort Eustis Mobilization Center.

Hazards and recommendations common to all job categories

1. Flooding/driving hazards/vehicular traffic

   When entering moving water, you are at risk for drowning, regardless of your ability to swim. Those in vehicles are at greatest risk of drowning, so it is important to comply with all hazard warnings on roadways and to avoid driving vehicles or heavy equipment into water of an unknown depth.

   Recommendations

   a. Avoid distractions while driving, including the use of cellular phones.

   b. Avoid driving across or into flooded roads since water level may cause the car to float and be washed away.

   c. Do not step into fast-moving water of unknown depth - only 6 inches of rapidly moving water can sweep a person off his/her feet.

2. Electrical Hazards

   Downed power lines and wet electrical circuits/equipment.

   Recommendations

   a. Assume that all power lines are energized, even in areas of widespread power outage. Electrocutions have been documented where back-feed electrical energy was present in power lines that were assumed to be de-energized. Back-feed may occur if an emergency generator is operated without being completely isolated from the power circuit. Back-feed energy may be present even if a generator is not seen or heard.

   b. Be aware that downed power lines may be hidden by debris. Exercise caution and awareness in areas where power lines may be present.

   c. Assume that electrical circuits and equipment are unsafe if there has been water in the area. Further information on electrical and other hazards associated with flood cleanup can be found on the NIOSH website at http://www.cdc.gov/niosh/flood.html.

3. Structural Integrity

   Flooding can damage walkways, roads, parking lots, and buildings. Water-damaged structures or ground cannot be assumed to be stable. Buildings that have been

submerged or exposed to flood waters may have suffered structural damage which could render the building unsafe.

Recommendations

a. Assume that all stairs, floors, and roofs in flooded or previously flooded buildings are unsafe until these structures are inspected and certified as safe by a registered professional engineer or architect.

b. Do not approach the edge of a washout, trench, ditch, or stream where water has compromised soil stability. Such areas may collapse, resulting in injury or drowning.

4. Sanitation

Flooding may result in sewage treatment plants pumping or dumping untreated sewage into rivers which are a source of drinking water for many towns. Animal waste (e.g., swine and poultry) from treatment lagoons may be introduced into the same rivers. Runoff from pastures may contribute to the contamination. Chemicals such as pesticides, fertilizers and petroleum products may be introduced into the surface water. Potential health consequences if the water is improperly filtered and disinfected include gastroenteric illnesses from bacteria, viruses or parasites and ingestion of toxins or chemicals that could possibly have long-term consequences. An organism of concern is *Cryptosporidium parvum*. This parasite is spread by fecal-oral transmission of oocysts that are extremely resistant to standard chlorination practices. Filtration can also be difficult because the oocysts are small (4-6 microns). Infection by this parasite can cause a lengthy watery diarrhea, which may be profuse, preceded by anorexia and vomiting in children, and it is a major opportunistic infection in immuno-compromised persons. Risk of infection increases with contamination of the drinking water supply by either untreated human sewage or animal waste since *C. parvum* is a common pathogen of humans and animals. Cryptosporidium has been implicated in outbreaks associated with both large and small municipal water systems and private wells contaminated by untreated sewage or runoff.

Recommendations

a. Assume that all water in flooded or surrounding areas is not safe unless the local or state public health department has specifically declared it to be safe.

b. FEMA should ensure that each employee is provided with an adequate supply of bottled water prior to departing from the IOF and/or DFO.

5. Mosquitos

Pools of standing water become breeding grounds for mosquitos, increasing the risk of encephalitis and West Nile Virus.

Recommendation

a. FEMA employees should be advised to wear clothing with long sleeves and long pants. Each FEMA employee should be provided with an insect repellent containing DEET. Because the instructions for safe use of DEET and safe use of sunscreen are different, the Centers for Disease Control and Prevention (CDC) does not recommend using products that combine DEET with sunscreen. If sunscreen is needed, it should be applied as a separate product prior to using repellent.

5. Sun Exposure

FEMA employees may be exposed to the sun while meeting with the public in disaster areas.

Recommendation

a. Sunscreen with a sun protection factor (SPF) of at least 15 should be provided and used. Employees should be instructed to wear protective clothing such as head gear with wide brims and ear covers, tightly woven clothes that protect sun-exposed areas of the body, and ultraviolet-blocking sunglasses. Sunscreen should be reapplied and used according to the instructions on the package.

6. Physical requirements

DAEs often work 12 hours or more hours per day, 7 days per week, in potentially hazardous situations.

Recommendation

a. The physical requirements of the all job categories should be assessed.

7. Ergonomics

All FEMA employees are expected to write and submit their reports using a FEMA-issued laptop computer. The employees are expected to carry these computers and all the periphery with them in the field and then to transport them into the DFO or IOF or their hotel rooms for use. Also, IOF employees have to used laptops for 1 to 3 months at a time, and DFO employees have to use them for up to 18 months or longer. The ergonomics of the workstations have not been evaluated.

Recommendations

b. FEMA employees should be issued rolling computer cases to reduce the need to lift and carry their equipment.

c. Ergonomically designed workstations (chairs, tables, and computers) should be provided to FEMA employees.

Hazards and recommendations common to Rapid Needs, Preliminary Damage, Public, and Individual Assessors, and Community Relations

2. Walking/Working Surfaces

FEMA employees may be exposed to tripping hazards due to fallen tree limbs, building debris, etc. Loose boards with nails, and other sharp debris, pose the risk of foot injury if adequate footwear is not worn in areas where these hazards exist. Nails and other sharp debris may be hidden by standing water. Standing water may conceal uneven, unstable, or unsafe walking surfaces.

Recommendations

a. Do not to conduct FEMA business in the immediate vicinity of apparent, or suspected, hazards (i.e., tripping, puncture, unstable surfaces).

b. Provide steel-toed boots which have a steel shank. These boots would be for use in those areas where there is some standing water and/or puncture hazards may exist which cannot be avoided. (Avoidance should be the first course of action.)

c. FEMA employees should not attempt to wade through water which may conceal holes, unstable/uneven surfaces, or hazardous debris. Boots, described in the preceding paragraph, are for use in controlled/known circumstances only.

2. Heavy Equipment

FEMA employees will be sent into communities where heavy equipment is operating to remove debris, raze buildings, or rebuild roads. Persons in the vicinity of unloading operations could be run-over or struck by various types of heavy equipment, such as excavators, bulldozers, and backhoes.

Recommendations

a. FEMA employees should be given visibility vests, and the vests should be worn at all times while onsite.

b. Workers should be reminded that equipment operators may not be able to see or hear an approaching person. Be aware of surroundings. Listen for backup alarms.

c. Do not enter the swing radius of excavators, backhoes, and other equipment. Make observations from a safe distance.

3. Carbon Monoxide

Flood cleanup activities may involve the use of gasoline- or diesel-powered pumps, generators, and pressure washers. These engines release carbon monoxide (CO), a colorless, odorless, deadly gas, which can accumulate inside buildings or partially enclosed areas. CO may enter buildings if an engine is located near a building air intake. Outdoor grills, if used indoors or in poorly-ventilated areas, pose a risk of CO poisoning. During Hurricane Isabel, authorities in Pennsylvania received reports of CO poisonings associated with the loss of electricity involving gasoline-powered generators and an indoor sump pump. Additional information on carbon monoxide poisoning can be found in the NIOSH Alert, "Preventing Carbon Monoxide Poisoning from Small Gasoline-Powered Engines and Tools." This publication is available at http://www.cdc.gov/niosh/carbon2.html.

Recommendations

a. Be aware of the risk of CO poisoning in buildings if gasoline-, diesel-, or propane-powered equipment is in use. If this situation is encountered, leave the area immediately and advise building occupants of the danger posed by CO.

b. Learn to recognize the signs and symptoms of CO overexposure which include headache, nausea, weakness, dizziness, and loss of consciousness. FEMA representatives should educate the public about sources and conditions that could result in CO poisoning.

4. Moldy Buildings

Except for RNA, FEMA employees are likely to encounter mold in flooded buildings within a few days to weeks after the water subsides. Mold may be found on almost any porous surface, such as wallboard, carpet, upholstery, paper, and wood. All molds have the potential to cause health effects. Molds produce allergens, irritants, and, in some cases, toxins. The types and severity of symptoms depend on a number of factors, including the duration of exposure, and existing allergies and sensitivities. Inhaling mold spores, or touching mold can cause allergic reactions in sensitive individuals. These reactions can be immediate or delayed. Exposure to mold or spores may cause previously non-sensitive individuals to become sensitive. Repeated exposure has the potential to increase sensitivity. Molds can trigger asthma attacks in allergic individuals.

Recommendations

a. FEMA employees should avoid entering buildings where mold is visible, or which smell moldy.

b. *If* an assessment may involve prolonged close contact with, or disturbing a potential site of mold growth, or if employees suffer from allergies, a disposable N-95 NIOSH-approved respirator should be provided and worn. PPE for such an assessment should include eye protection and gloves (e.g., nitrile).

   Respirators need to be provided only when (1) conditions are favorable for mold growth (e.g., flooding of buildings), and (2) workers may experience significant exposure as described above. An N-95 respirator should offer adequate protection provided that the face piece fits tightly, ensuring that the contaminants do not enter through leaks between the respirator and wearer's face. For those individuals wearing respirators as prescribed by the employer, a complete respiratory protection program must be implemented that meets the requirements of the Occupational Safety and Health Administration (OSHA) respiratory protection standard (29 Code of Federal Regulations 1910.134). The minimum requirements for a respiratory protection program include: a written standard operating procedure for the selection of and use of respirators; the medical evaluation of workers to determine if they are physically able to wear the respirator selected for use; training and instructions on respiratory usage; the cleaning, repair, and storage of respirators; the continued surveillance of work area conditions for worker exposure and stress; and, a respirator fit-testing program.

5. Bloodborne Pathogens

   FEMA employees could be exposed to blood and other body fluids when assisting injured individuals and co-workers. The pathogens of primary concern are the human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV).

   Recommendation

   a. The FEMA Safety Manager should ensure that BBP training is provided in accordance with the OSHA Bloodborne Pathogen Standard, 29 CFR 1910.1030.

6. Hazardous Materials

   While in the field, FEMA employees may encounter hazardous materials during building surveys including, but not limited to, 55-gallon drums, household chemicals and propane tanks.

   Recommendations

   a. FEMA employees should avoid chemical drums, compressed gas cylinders, and fuel containers. All suspect materials should be reported to the appropriate state or local authority.

6. Airborne dust and falling debris

   FEMA employees may encounter airborne dust and falling debris.

   Recommendation

   a. FEMA employees should be provided with safety glasses or goggles to protect them from dust. Hard hats are needed where employees may be exposed to overhead hazards such as tree limbs, unsafe structural components, and falling debris.

7. Post Traumatic Stress and Other Job Stressors

   Symptoms include physical fatigue, poor concentration, nightmares, anxiety, grief, irritability, and depression, inability to rest, and anger or withdrawal. Job stressors include sleep deprivation, lack of food, and exposure to human and animal casualties

   Recommendations

   k. The need for crisis intervention following critical incidents is well-documented. Crisis intervention services should begin pre-crisis with education to understand the signs of stress and the symptoms that could indicate a need for intervention. Crisis intervention services must complement and augment natural recovery and restorative mechanisms. Individuals may need to defuse, debrief, or receive follow-up care to ensure that appropriate crisis intervention is provided, based on psychological readiness, rather than the passage of time.

   l. Keep supplies of food and water available at all times, and get plenty of rest between work shifts.

9. Hostile/dangerous persons

   Recommendations

   a. FEMA employees should be trained in risk communication and community relations skills to help reduce the likelihood of confrontational situations.

Hazards and Recommendations Specific to Certain Job Categories

Rapid Needs Assessment

1. Noise

   RNA team members are frequently deployed in helicopters immediately following a disaster. Helicopter deployment may expose team members to noise levels exceeding OSHA standards. Noise can also make communication between team members difficult or impossible.

   Recommendations

   b. Noise levels should be evaluated. Appropriate hearing protection, which also allows communication between team members, should be provided.

Mobile Emergency Response Support (MERS)

1. Overhead Power Lines

   When scaffolds or antennae contact overhead power lines, workers receive serious and often fatal injuries.
   Recommendations

   a. A distance of at least 2 feet should be maintained from insulated power lines of less than 300 volts. For insulated power lines of 300 volts or more, and for all uninsulated power lines, the separation distance should be at least 10 feet. For further information , see "Preventing Electrocutions During Work with Scaffolds Near Overhead Powerlines" on the NIOSH website at http://www.cdc.gov/niosh/91-110.html.

   b. FEMA employees should always use a spotter when raising antennae in areas where power lines are present.

1. Non-ionizing radiation

   MERS employees use multiple non-ionizing radiation-producing instruments as they work, including satellite phones, cell phones, walkie talkies, and wireless personal computers.

   Recommendation

   a. An evaluation of the cumulative non-ionizing radiation exposure should be conducted for MERS employees.

Debris Monitors

1. Vehicular Traffic

   Workers may be struck by trucks or overhanging loads.

   Recommendations

   a. Ensure that a traffic control system is implemented.

   b. Employees should be instructed to be especially alert when in the vicinity of large vehicles and equipment. Employees should be instructed to avoid walking immediately behind large trucks where they cannot be seen by the driver. Employees should be reminded to be aware of backup alarms. Do not approach a truck until it has come to a complete stop.

c. Visibility vests should be worn throughout the debris site.

2. Chippers and Grinders

Moving parts pose a hazard to persons in the immediate vicinity of chippers and grinders. Tub grinders reportedly throw projectiles 100 feet or more. Airborne wood chips could cause eye injury. Debris is loaded into chippers and grinders using heavy equipment which could strike or run-over persons who approach operating equipment.

Recommendations

a. Establish a 300 foot danger zone around tub grinders. Do not enter the danger zone if the machine is operating. Leave the danger zone before the machine is started.

b. Hard hat and safety glasses should be worn if there is any possibility that the DM could be exposed to projectiles. Safety glasses should be worn wherever the DM could be exposed to airborne debris (e.g., wood chips).

c. Do not approach excavators or other equipment which are being used to load chippers and grinders.

3. Observation Towers

An unstable or poorly constructed tower may create a fall hazard. Scissor lifts should never be used in lieu of a properly constructed tower. Trucks and/or overhanging debris can damage or topple a tower. Overhanging branches may strike persons on the tower. Tower occupants may be exposed to sun and the elements, as well as smoke from the burn pit.

Recommendations

a. Instruct employees not to climb any tower that appears to be unstable or poorly constructed. A well-constructed tower will be securely anchored, and will have standard railings on all sides of the platform. A 4-inch toeboard should be installed on all sides if workers will be walking beneath the platform. Stairs must be fitted with a standard stair railing. The tower should provide adequate protection from sun and the elements.

b. A visible concrete/stone barrier and/or fluorescent cones should be used to maintain a safe distance between trucks and the tower.

c. Sunscreen with a sun protection factor (SPF) of at least 15 should be provided and used. DMs should be instructed to wear protective clothing such as head gear with wide brims and ear covers, tightly woven clothes that protect sun-exposed areas of the body, and ultraviolet-blocking sunglasses.

4. Hazardous Materials

Propane tanks, compressed gas cylinders, and other unknown or hazardous materials in the debris stream.

Recommendation

a. Propane tanks, compressed gas cylinders, and other unknown or hazardous materials should be separated from the debris stream. Hazardous materials may be handled only by workers who have been trained per the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (Hazwoper) Standard. The appropriate state or local authority should be contacted to handle and collect these items.

5. Other Site Hazards

Foot injury (crushing or punctures). Head injury from falling debris or contact with equipment. Eye injury due to flying wood chips. Drinking water may not be readily accessible. Sanitary facilities (toilets and hand washing).

Recommendations

a. The possibility of foot injury warrants the wearing of sturdy footwear as a minimum requirement: no sneakers or open-toed footwear should be allowed. Steel-toed safety shoes may be necessary if DMs are required to enter areas where falling debris could cause foot injury. If nails or other sharp metal objects are present in the debris stream, steel-shanked footwear should be worn if the DM will be walking near these hazards.

b. Hard hats should be mandatory wherever there may be falling objects or other hazards which could result in head injury.

c. Safety glasses should be mandatory where DMs could be exposed to flying wood chips or other debris.

d. All PPE should be provided prior to deployment to debris sites.

e. Each DM should be provided with an adequate supply of drinking water before departing to debris sites. (Note: Couriers are going to deliver water to DMs at Virgina debris sites.)

f. An adequate number of portable toilets and hand washing facilities (soap and water) should be provided and maintained in a clean and sanitary condition.

Security Staff

1. Bloodborne Pathogens

Security personnel could be exposed to blood and other body fluids when assisting or detaining injured individuals. The pathogens of primary concern are the human immunodeficiency virus (HIV), hepatitis B virus (HBV) and hepatitis C virus (HCV).

Recommendation

a. The FEMA Safety Manager should evaluate the BBP program to ensure that adequate training is provided to Security Officers. Training should be repeated and documented at least annually in accordance with the OSHA Bloodborne Pathogen Standard, 29 CFR 1910.1030.

2. Hazardous Materials

Security officers may encounter hazardous materials during building surveys or while responding to calls.

Recommendation

a. Security personnel, who may respond to the scene of an uncontrolled chemical release, must receive emergency responder training per the Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (Hazwoper) Standard. The level of training will depend upon the nature of the response that may be required. At a minimum, awareness level training is needed which will provide an understanding of what hazardous materials are, and potential outcomes of hazardous material emergencies. Awareness training should enable officers to recognize the presence of hazardous materials, and to make appropriate notifications to hazardous materials responders.

Logistics and Mobilization Centers

3. Lifting and musculoskeletal disorders

Back injury may occur if employees lift excessive weight and/or must engage in repetitive lifting. Improper lifting technique and/or awkward positions increase the likelihood of back injury or other musculoskeletal injury.

Recommendations

a. Provide lifting training. Training should identify and describe lifting hazards, methods to prevent injury, and proper lifting techniques.

b. Ensure that staff is adequate for the tasks to be performed. Stress and overwork may increase the likelihood of injury.

1. Foot Injury

   Pallets or heavy objects can drop on unprotected feet. Pallet jacks can run over feet.

   Recommendation

   a. Steel-toed shoes should be required where workers handle pallets or heavy items.

2. Forklift Training

   Persons who have not received adequate training are likely to place themselves and others at risk of injury or death resulting from fork truck accidents.

   Recommendation

   a. Ensure that all forklift operators are trained, evaluated, and certified. Training should be equipment- and site-specific. Operators should be able to identify equipment deficiencies, as well as understanding safe operating practices and procedures.

4. Working near trucks and large equipment

   Employees may be struck by tractor trailers, fork trucks, or other heavy equipment.

   Recommendations

   a. Employees should be instructed to be especially alert when in the vicinity of large vehicles and equipment. Training/instructions should address the operating characteristics and specific hazards associated with each type of vehicle or equipment that may be encountered at the Mobilization Center. Employees should be reminded not to walk near the rear of vehicles where they could be struck if the vehicle backed-up. Workers should be instructed not to approach large equipment until making eye contact with the operator, and ensuring that the operator is aware that someone is approaching. Do not approach trucks or machinery until movement is halted.

   b. Visibility vests should be required of employees in areas of high traffic or heavy equipment activity. Reflective vests should be worn for night work in these areas.

5. Helicopters

   Recommendation

   a. Although helicopters were not in use during this site visit, hazards associated with helicopters were mentioned during discussions with logistics staff. Hazards to

ground personnel and helicopter passengers should be evaluated by FEMA safety staff. Training and PPE should be provided based on anticipated hazards. FEMA should ensure that all requirements of the OSHA Helicopter Standard (29 CFR 1910.183) are met.

Occupation Safety and Health Planning/Management

FEMA managers and employees indicated that occupational safety and health programs/plans are not implemented until a disaster has been declared. At such time the Safety Manager must create a safety plan to address the multitude of hazards that may be encountered by the various FEMA teams. There is no apparent mechanism for ensuring continuity and uniformity of site occupational safety and health programs within FEMA. It appears that safety and health programs and training are not shared between the three on-call teams nor within each team. This situation is complicated by use of DAEs who are deactivated between disasters. Safety Manager DAEs are not available to develop safety programs and conduct training between disasters, and the potential DAE recipients of this training are not available to receive it. Other than on-the-job training that may be provided, DAEs are expected to be able to respond to any disaster without benefit of appropriate occupational safety and health training.

PPE is not usually provided prior to potential exposures. For example, Logistics employees were not provided with steel-toed shoes prior to setting up the DFO, and Debris Monitors were deployed prior to procurement of PPE. (Note: PPE for DMs was on order at the time the NIOSH evaluation). Personnel from various teams described a PPE policy which does not ensure that appropriate PPE is provided, required, or used.

Occupational accident and illness records are maintained by Workers' Compensation staff. These records are not available to the safety manager. Thus, NIOSH investigators could not obtain records for this response, nor for previous responses. Historical accident and illness data would have been very helpful for identifying specific tasks which present a high risk. More importantly, these data would be very useful to the onsite safety manager who is responsible for identifying and addressing workplace hazards.

Recommendations

1. A comprehensive Occupational Safety and Health Management Program should be established to reduce the risk of work-related injuries and illnesses, and to control Workers' Compensation costs. An effective Occupational Safety and Health Program includes: (1) management commitment and employee involvement, (2) worksite analysis to anticipate and prevent injuries/illnesses associated with various types of disasters, (3) hazard prevention and control, and 4) safety and health training for all personnel at all sites. Occupational safety and health responsibilities should be integrated into the job descriptions and performance evaluations for all managers, supervisors, and employees. The program should be uniformly implemented across the three on-call response teams.

Further information on effective safety and health program management can be found on OSHA's website at: http://www.osha.gov/SLTC/safetyhealth/index.html.

1. The appropriate time to conduct occupational safety and health planning and training is prior to a response, rather than during an emergency. The time between responses should be utilized to develop the safety and health program. Safety managers from all on-call teams should be involved in the development of the program. Employees who may need to wear respirators and other PPE should be trained before they are deployed into the field.

2. Based on observations and discussions during this site visit, NIOSH investigators believe there is a need for a coherent PPE program. Elements of a PPE program include: (1) an in-depth evaluation of hazards which necessitate the use of PPE, (2) development and implementation of standard operating procedures for providing and using PPE, (3) training employees in the use, maintenance, and limitations of PPE, (4) assessing employee understanding of PPE training, (5) providing medical evaluations for employees who may be required to use respiratory protection, and (6) providing PPE to employees prior to deployment into areas where they may encounter hazards. A policy should be developed to procure, or reimburse employees for necessary/required safety shoes and prescription safety glasses.

3. Each employee, who is deployed to an area where hazards may be encountered, should be provided with a "go kit" containing all PPE which *may be* needed in the field. Employees should be required to carry this kit with them while in the field. PPE use should be mandatory, i.e., it should be an integral part of the assigned job.

5. Employees (including those who are pre-positioned prior to an incident) should receive a safety briefing prior to deployment. The briefing should address hazards specific to the type of disaster and anticipated response activities. A FEMA safety plan should be developed and distributed to all FEMA response workers. The plan should be reviewed during the safety briefing.

6. Injury and illness records should be analyzed to identify hazards encountered during the performance of various tasks during responses. Analysis of trends will help to identify and prevent common causes of injuries/illnesses. Reports of "near miss" events may help identify causes of accidents, as well as methods of preventing accidents. To accomplish this, records must be readily available to safety managers.